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CONCEPTS AND METHODS OF ENVIRONMENT STATISTICS HUMAN SETTLEMENTS STATISTICS– A TECHNICAL REPORT

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PREFACE

Under the guidance of the Statistical Commission of the United Nations and with the financial support of the United Nations Environment Programme (UNEP), the Statistical Office of the United Nations Secretariat launched a phased programme for the development of environment statistics. The first phase (1978-1982) consisted of surveys of data needs and statistical practices of countries and international organizations. The results of these surveys have been presented in two publications, the Survey of Environment Statistics: Frameworks, Approaches and Statistical Publications 1/ and the Directory of Environment Statistics. 2/ The surveys revealed the need for a flexible framework which would facilitate the organization and development of statistics on the complex subject of the environment.

The current second phase of the programme has been devoted to the development of A Framework for the Development of Environment Statistics (FDES) 3/ and to providing further methodological guidance for the establishment of environment statistics at the national level. The framework was used in particular to determine the scope and coverage of environment statistics. In this regard it may be noted that the scope and contents of FDES have been based on the perception of environmental problems and statistical priorities of countries as expressed in regional workshops and national pilot studies organized by the Statistical Office of the United Nations Secretariat, in co-operation with the United Nations regional commissions, UNEP and other organizations.

Environment statistics were found to cover elements of the natural as well as the "man-made" environment or human settlements, including a wide range of human activities, natural events and environmental impacts. Environment statistics thus comprise not only ecological and monitoring data, but also social, demographic and economic statistics. These statistics are produced primarily for non-environmental purposes but can also be used, usually after further processing, to meet environmental data needs.

At its twenty-third session, the Statistical Commission of the United Nations requested that a technical manual for the compilation of selected high-priority statistics in the areas of human settlements and natural resources be prepared by the Statistical Office. 4/ However, as environment statistics are still at a relatively experimental stage of development, it was deemed more appropriate to present concepts and methods of such statistics as a series of technical reports rather than a manual.

The present report deals with the environmental issues of human settlements statistics. A further report on "Statistics of the Natural Environment" is currently being prepared. Both reports are based on the structure and principles of FDES. By applying FDES in this manner, the environmental aspects of natural resources and human settlements statistics were determined, identifying in particular those social, demographic and economic statistics that should be included in environmental assessments. For most of these statistics, international methodological recommendations are already available and are referred to in the reports where applicable.

The major purpose of the technical report series is to propose concepts, definitions and classifications for statistical variables that describe high-priority environmental issues in most countries and that can be compiled by

national statistical services in an environment statistics programme. Extensive use of national and international compendia of environment statistics has been made in order to identify those concepts, definitions, classifications and data sources which are most widely applied. The statistical variables identified in this manner are thus likely to reflect typical data needs of planners, policy-makers and administrators in environmental and related socio-economic fields.

Even then, the sets of variables presented in the report may still be too extensive for the initial phases of an environment statistics programme. The goal is, however, to provide national statistical offices at least with a starting point for a first selection of appropriate statistical series and to assist them in the determination of relevant definitions, classifications and data sources. From this point of view, the report can be considered as an extension of the original FDES, that is, as a framework that facilitates the establishment of environment statistics programmes, rather than an international recommendation of generally accepted concepts, definitions and classifications. Particular environmental conditions, data needs and statistical capabilities may well require data sets that differ both in scope and in content from those presented in this report.

It is intended to promote the application of the methodologies proposed in this report and its companion, the forthcoming report on statistics of the natural environment, at the regional level in co-operation with the regional commissions of the United Nations and other interested international organizations. Experience gained from applying the reports in countries is expected to lead to further modification, revision and extension. Hopefully, the reports will thus become an important tool in the development and harmonization of environmental data collection at national and international levels.

Various drafts of the report were circulated to United Nations bodies, other international organizations and experts in the field for discussion of its format, technical contents and application. The numerous comments and contributions received are gratefully acknowledged here. Any further comments on this first attempt to present a consistent picture of concepts and methods in a new and rapidly developing field of applied statistics are not only welcome, but are deemed invaluable for refining and standardizing the existing methodologies.

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Reference to "tons" indicates metric tons, unless otherwise stated.

A hyphen (-) between years, e.g., 1984-1985, indicates the full period involved, including beginning and end years; a slash (/) indicates a financial year, school year or crop year, e.g., 1984/85.

The following symbols have been used in the tables:

Two dots (..) indicate that data are not available or are not separately reported.

INTRODUCTION

A. The nature of environment statistics

1. Environment statistics are interdisciplinary, their sources are dispersed and a variety of methods are applied in their compilation. Environment statistics therefore aim to provide a synthetic presentation of data from various subject areas and sources in order to assist in the formulation and evaluation of integrative socio-economic and environmental policies. The scope of environment statistics includes the media of the natural environment (air/climate, water, land/soil), the biota found within these media and human settlements. Within this broad range of subject areas, environment statistics describe the quality and availability of natural resources, human activities and natural events that affect the environment, the impacts of these activities and events and social responses to these impacts.

2. Environment statistics are compiled, stored and disseminated by central statistical services, government departments, research institutes, local authorities and international organizations. They are collected through censuses, surveys, the use of administrative records and monitoring networks. In general, the collection and compilation process differs considerably from the survey techniques employed in social and economic statistics. For instance, data describing natural resources and environmental quality are based on physical parameters, often in terms of their spatial attributes. Such data are typically dispersed through numerous agencies, departments or institutes, requiring considerable efforts to attain compatibility and accuracy. The same institutions are also the major users of environment statistics. Further demand for environmental data arises from business and industry, scientists, the mass communication media and the general public.

B. Framework for the Development of Environment Statistics 5/

3. The interdisciplinary character of environment statistics and the variety of data producers and users call for a comparative analysis of data availability and the co-ordination of data collection, processing and dissemination. The systematic development and organization of a complex field of statistics is a familiar concern which has been addressed by means of statistical systems, frameworks, or less rigorous methodological guidelines. Various national and international efforts have been made towards developing a system or framework of environment statistics, either for planning a programme of such statistics or for presenting available data in a coherent statistical publication. These efforts were surveyed by the Statistical Office of the United Nations Secretariat 6/ in order to identify common characteristics which could be incorporated into a widely applicable international framework.

4. Based on the results of these surveys, A Framework for the Development of Environment Statistics (FDES) was prepared by the Statistical Office. The major objective of FDES is to assist in the development, co-ordination and organization of environment statistics. More specifically, FDES is designed to:

(a) Review environmental problems and concerns and determine their quantifiable aspects;

(b) Identify variables for statistical descriptions of the quantifiable aspects of environmental concerns;

(c) Assess data requirements, sources and availability;

(d) Structure data bases, information systems and statistical publications.

5. FDES relates components of the environment to information categories, as shown in table 1. The components of the environment define the scope of environment statistics. Statistics of the natural environment thus refer to the environmental media of air, water and land/soil, as well as the biota (flora and fauna) found in these media. Statistics of the "man-made" environment are the subject of the present report; they focus on human settlements which consist of physical elements, namely shelter and infrastructure, and services to which these elements provide the material support.

Table 1. Format of the Framework for the Development of Environment Statistics

	Information categories			
Components of the environment	Social and economic activities, natural events	Environmental impacts of activities/ events	Responses to environmental impacts	Stocks, inventories and background conditions
Flora				
Fauna				
Atmosphere				
Water (a) Freshwater (b) Marine water				
Land/soil (a) Surface (b) Sub-surface				
Human settlements				

6. The information categories of FDES reflect the fact that environmental problems are the result of human activities and natural events. Human activities and natural events exert impacts on the environment which in turn provoke individual and social responses to avoid or mitigate these impacts. A priori, such a sequence of action, impact and reaction would suggest further analysis of

cause-effect relationships. However, such relations are not specified in FDES. Its purpose is primarily organizational rather than explanatory, focusing on the identification, description and presentation of data variables which, on the other hand, should be useful in tracing and verifying these interrelationships.

7. The contents of FDES are termed "statistical topics". They describe those aspects of general environmental concerns which can, at least theoretically, be subjected to statistical assessment. The determination of statistical topics under each information category constitutes an important step towards the identification of relevant statistical variables for each topic. The statistical topics are reviewed in some detail throughout the present report. The brief description which follows, of the information categories under which the statistical topics are presented in FDES, shows the definitional characteristics of both the information categories and their respective statistical topics.

(a) **Social and economic activities, natural events**

8. Human activities and natural events included under this category are those that may have a direct impact on the different components of the environment. Human activities consist mostly of the production and consumption of goods and services, but could also include activities in pursuit of non-economic goals. They produce environmental impacts through the direct use or misuse of natural resources or through the generation of waste and emissions in production and consumption processes. Natural events and disasters are also included in this information category, because human activities frequently contribute to natural disasters and because natural events may create impacts on all environmental components.

(b) **Environmental impacts of activities/events**

9. The statistical topics under this information category represent impacts of socio-economic activities and natural events. Responses to environmental impacts (see para. 10) also affect the environment and, ultimately, human welfare. Environmental impacts, which may include the depletion or discovery of natural resources, changes in ambient concentrations of pollutants and deteriorating or improving living conditions in human settlements, can thus be harmful or beneficial.

(c) **Responses to environmental impacts**

10. Individuals, social groups, non-governmental organizations and public authorities respond to environmental impacts in different ways. Their responses intend to prevent, control, counter, reverse or avoid negative impacts and to generate, promote or reinforce positive ones. Policies, programmes and projects designed to this end include the monitoring and control of pollutants, the development and application of environmentally sound technologies, changes in consumption patterns, management and sustainable use of natural resources, the prevention and hazard mitigation of the effects of natural disasters and the development of human settlements.

(d) **Stocks, inventories and background conditions**

11. Statistical topics in this category are intended to provide "benchmark" data and to illustrate links with other subject areas for possible further statistical analysis of these relationships. They include the stocks of natural resources and of capital assets of human settlements and refer to environmental inventories, as

well as to economic, demographic, meteorological or geographical background conditions.

C. Purpose and organization of the report

12. The major purpose of the report is to propose concepts, definitions and classifications for statistical variables which describe environmental and related socio-economic aspects of human settlements. The statistical variables presented in the report were selected primarily with the data needs of general environmental planners, policy-makers and administrators in mind. In addition, these statistics should provide technical managers and administrators with supportive base line data to complement specialized research information. To the extent possible, statistical variables were also selected on the basis of their potential use for calculating environmental indicators and indices. More specific criteria used in selecting the variables are (a) relevance to environmental (human settlements) issues and to corresponding FDES topics, (b) data availability and access, (c) degree of sensitivity to change in environmental and human settlements conditions and (d) international comparability.

13. The lists of variables are neither exhaustive nor the only possible ones for the assessment of the statistical topics. Particular situations and priorities in countries may well demand different selections and formulations of statistical topics and related variables. In most cases, the report will provide at least a starting point for a first identification of appropriate statistical series and will also help to determine relevant classifications and data sources. The flexible "building-block" structure of FDES, on which the report is based, permits the selection or rearrangement of topics and corresponding statistical variables for comprehensive assessments and selective studies of environmental conditions in countries.

14. The report does not provide recommendations on how to implement a statistical programme. Apart from indicating typical data sources and some examples of data presentation (see para. 17 below), actual data collection, processing, storage in and retrieval from data bases, or procedures of data dissemination and publication are hardly discussed. Widely differing administrative arrangements and capabilities in both, environmental/human settlements policies and data collection, are the reason that these issues will be approached on a case by case basis rather (see para. 155 below).

15. The present report describes statistics on the "man-made" environment, covering the FDES component of human settlements. A further technical report, which is currently being prepared, will deal with the natural environment, including statistics on the remaining FDES components of fauna, flora, atmosphere, water and land/soil. 1/ The general breakdown of both volumes follows the FDES information categories described above. The outline below illustrates the scope and contents of the companion volume on statistics of the natural environment:

A. Social and economic activities, natural events

1. Use of resources and related activities

2. Emissions and discharges

3. Natural events

B. Environmental impacts of activities/events

1. Resource depletion or increase

2. Ambient concentration of pollutants and waste

3. Biological and ecological impacts

4. Human health and welfare effects

C. Responses to environmental impacts

1. Resource management

2. Pollution monitoring and control

3. Prevention and hazard mitigation of natural disaster

D. Stocks, inventories and background conditions

1. Stocks of natural resources

2. Environmental inventories

3. Background conditions.

16. The application of FDES in the organization and structuring of the present report allows the use of a coding system which assigns capital letters to information categories, numbers to statistical topics and small letters to statistical variables. For instance, A.2.1.d refers to the variable (d), Solid waste collected, under the statistical topic 2.1, Emission and waste discharge, which is part of A.2, Other activities, of the section A, Social and economic activities, natural events.

17. For each statistical topic, the report provides:

(a) A description of the topic and related environmental and human settlements concerns;

(b) A listing of the statistical variables and their classifications with an indication of the reasons for selecting a particular variable and with explanations regarding concepts, definitions and classifications;

(c) An indication of likely data sources and methods of data collection.

In some cases, particularly useful tabulations, other means of data display, such as mapping or graphic presentation and possibilities of further processing the basic data into indicators or indices are also outlined.

18. The text of the report refers to an annex which lists all statistical variables in tabular format and in the above-described coding system. For each variable, units of measurement, definitions and explanations, classifications and

likely data sources are also presented. The annex should be particularly useful for applications in national statistical programmes. The textual part, on the other hand, aims to provide additional information on the statistical variables for the analysis and use of environment statistics.

I. SCOPE AND NATURE OF HUMAN SETTLEMENTS STATISTICS

A. The concept of human settlements

19. Human settlements are a major component of the Action Plan for the Human Environment which provides detailed recommendations for the planning and management of human settlements for environmental quality. 8/ The United Nations Conference on Human Settlements (Habitat) elaborated on many of these recommendations and gave a first comprehensive description of the concept of human settlements:

> "The fabric of human settlements consists of physical elements and services to which these elements provide the material support. The physical components comprise shelter, i.e. the superstructures of different shape, size, type and materials erected by mankind for security, privacy and protection from the elements and for his singularity within a community; and infrastructure, i.e. the complex networks designed to deliver to or remove from the shelter people, goods, energy or information. Services cover those required by a community for the fulfilment of its functions as a social body, such as education, health, culture, welfare, recreation and nutrition." 9/

20. More recent descriptions of the nature of human settlements focused on the interaction of human, economic and socio-cultural activities within their particular physical environment. The development and maintenance of human settlements has thus been found to "constitute both one of the fundamental aims and one of the basic prerequisites for equitable and sustainable development". 10/

B. Human settlements concerns

21. The improvement of the quality of life in human settlements, has been considered "the first and most important objective of every human settlements policy". 11/ The availability and quality of the elements and services of human settlements described above determine to which extent this objective is met. More specific concerns of human settlements were also identified at the Habitat Conference. From an environmental point of view, such concerns were addressed by an international review of the "Environmental Perspective to the Year 2000 and Beyond". 12/ Human settlements concerns were also analysed specifically for statistical purposes in a number of regional workshops and pilot country studies organized or sponsored by the Statistical Office. In reference to human settlements questions, the following issues have generally been raised in these declarations and analyses:

(a) Rapid population growth, migration and urbanization;

(b) Inadequate shelter and basic amenities, especially in "marginal" settlements;

(c) Overcrowding and urban decay;

(d) Environmental degradation, especially through waste discharge and other forms of pollution;

(e) Lack of services and related infrastructure in rural and urban settlements, especially water supply and sanitation;

(f) Impairment of the cultural heritage;

(g) Health effects and deteriorating living conditions.

22. All these issues include or affect the social, economic or environmental aspects of human settlements. In fact, any development of human settlements involves a transformation of the natural environment into a man-made environment, giving rise to a variety of environmental concerns. Rapid urbanization was singled out in particular by the World Commission on Environment and Development as one of the most challenging features of the development of human settlements, affecting the environment within human settlements as well as the area surrounding them. 13/

23. Given the multitude of factors affecting human settlements concerns, separate descriptions of these concerns cannot provide the information required for integrated planning and policy-making. For these reasons, an integrative approach has been chosen by describing the above general concerns within the broad Framework for the Development of Environment Statistics (FDES). Table 2 presents the statistical topics of human settlements in the Framework format, grouped together according to common characteristics (underlined). Each statistical topic and the variables selected to represent them are discussed in the text and listed with detailed annotations in the annex.

24. As described above in the introduction, FDES translates general environmental concerns into more operational statistical topics. In this manner, it highlights the environmental aspects of human settlements without losing track of their relationships with other socio-economic and cultural issues. Still, the focus of FDES is on environmental impacts, and economic, social and demographic activities are considered only to the extent that they produce such impacts. Those factors which do not directly influence environmental aspects of human settlements, but which are related to activities that do, are (or could be) listed as "background conditions" (see chap. II, sect. D). This applies, for example, to such issues as the socio-economic stratification and ethnic composition of the inhabitants of human settlements, industrialization or overall climatic conditions. Well-developed statistical systems in the fields of economic, social and demographic statistics already cover these topics in depth. Cross-references between "background information" and human settlements data indicate possibilities for a broader approach to human settlements statistics.

Table 2. Framework for the development of environment statistics - human settlements

Social and economic activities, natural events A	Environmental impacts of activities/events B	Responses to environmental impacts C	Stocks, inventories and background conditions D
1. Settlements growth and change 1.1 Population growth and change 1.2 Construction of shelter and infrastructure 1.3 Utilities (energy and water supply 1.4 Transport 1.5 Land use in human settlements 2. Other activities 2.1 Emission and waste discharge 2.2 Hazardous activities at workplace [not developed] 3. Natural events	1. Conditions of shelter, infrastructure and services 1.1 Housing 1.2 Access to infrastructure and services 1.3 Human settlements sprawl and dispersion 2. Conditions of life-supporting resources 2.1 Ambient concentration of pollutants and wastes 2.2 Biological and ecological impacts [not developed] 2.3 Microclimates [not developed] 3. Health and welfare conditions in human settlements 3.1 Exposure and health effects 3.2 Settlements-related damage and accidents 3.3 Perception of the quality of life in human settlements	1. Human settlements policies and programmes 2. Pollution monitoring and control 2.1 Environmental standards 2.2 Monitoring 2.3 Treatment, disposal and reuse of discharges 2.4 Expenditure for pollution control 3. Prevention and hazard mitigation of natural disaster	1. Stocks of shelter and infrastructure 1.1 Housing stock 1.2 Non-residential buildings and other physical infrastructure 2. Environmental inventories 2.1 Emissions 2.2 Hazardous work environment and industries [not developed] 2.3 Human settlements vulnerable to natural disasters 3. Background conditions 3.1 Land use 3.2 Demographic and social conditions 3.3 Economic situation 3.4 Weather/climate conditions

C. General methodological issues

25. This section deals with general methodological questions that are repeatedly encountered throughout this volume of the report. The distinction between rural and urban settlements is an issue that has not yet been resolved satisfactorily, especially for international comparison. Similarly, low-income settlements defy generic definition and classification because of the widely differing characteristics of "slums" and illegal settlements and their complex relationships to "informal sector" activities. Data availability and collection from disparate sources are a general problem of environment statistics; in the context of human settlements, this problem is particularly apparent in attempts to assess "marginal" settlements conditions and to relate monitoring data to more conventional socio-economic statistics.

26. The geographical breakdown of data is essential for environmental analysis. Environmental impacts occur in and through components and processes of ecosystems, and even urban systems have been considered as ecosystems in "integrated ecological approaches to human settlements planning". 14/ Obviously, administrators of particular settlements require full sets of data for each settlement they are concerned with. However, as indicated in the introduction, environment statistics as proposed here address mainly national planners and policy-makers, providing base line data only to technical managers or administrators of particular ecosystems or settlements. Other criteria for overall classifications of human settlements that can be applied throughout the country need to be found.

27. A prevalent methodological issue in the assessment of human settlements is the statistical description of **rural and urban** characteristics of settlements. There is no internationally agreed upon classification that can be used to define a settlement as "rural" or "urban", because characteristics that set apart these areas vary widely from country to country. 15/ The Compendium of Human Settlements Statistics 16/ presents national data for the capital city and the three other largest cities or urban agglomerations. If statistics are not available for the "administrative city" (defined according to legal or political boundaries established in each country for each city), data are given for "urban agglomerations". Urban agglomerations comprise the administrative city or town as well as the suburban fringe or thickly settled territory lying outside, but adjacent to, its boundaries.

28. The present report proposes to show human settlements data for major cities and other selected settlements, and, following international recommendations, in a further **classification** of settlements **by population size.** The classification of settlements by population size can usefully supplement or even replace the concepts of urban and rural "where the major concern is with characteristics related only to density, along the continuum from the most sparsely settled areas to the most densely built-up localities". 17/ Moreover, national definitions of urban and rural are frequently determined by the size of localities in terms of population. The use of population size may thus not only conform to current definitions of urban and rural areas but will also improve the comparability of the statistical results.

29. Since the classifications by major cities and selected other settlements and by population size of settlements should be applied wherever possible throughout the report, they are usually not indicated explicitly in the annex and text tables. Similarly, a further possible classification by **sub-national regions** or

administrative areas is not indicated but can be applied as an alternative or complement to the classification by settlements. Such a classification allows for the fact that most socio-economic and demographic data are readily available for administrative areas other than the areas defined by human settlement boundaries. Moreover, for purposes of statistical analysis, information on ecosystems or ecoregions is sometimes built up from the smallest administrative "unit area" for which data are available. To present human settlements data for regions or administrative areas may thus help to link human settlements data to related socio-economic and environmental information obtained from different data sources.

30. The assessment of those housing units which are frequently described as **"slums"** or **"squatter settlements"** is a major cross-sectional issue that is not adequately covered by the statistics proposed. Slums refer to areas of older housing which are deteriorating in the sense of being under-serviced, overcrowded and dilapidated. Squatter settlements are areas where housing units have been constructed on land to which the occupants have no legal claim; they are usually found in suburban areas, particularly at the peripheries of principal cities. In housing censuses and in the present report, these housing units are referred to as "marginal" in a classification applied to the construction of housing units (A.1.2.a), their occupation (B.1.1.a) and their stock (D.1.1. a-e). Marginal housing units are further subdivided into three sub-groups: (a) improvised housing units; (b) housing units in permanent buildings not intended for human habitation; and (c) other premises not intended for human habitation. In reference to this classification, the generic term of "marginal settlements" is used in this report. However, this should not obscure the fact that the economic contribution of such settlements, especially from "informal" activities, can be quite significant. 18/

31. **Data availability** and comparability are major problems of the assessment of marginal settlements, which may differ in size, location, density, growth rates, terrain, type and age of construction, sanitation or infrastructure. In addition, there are other differences that cannot be determined by mere physical data, such as the degree of social cohesion among inhabitants, their ethnic composition, their aspirations, skills and health conditions. These factors may vary from country to country, within countries and even from one part of a city to another. To a limited extent, these factors are addressed in the report under the topics of land use (A.1.5.b area of marginal settlements), access to infrastructure and services (B.1.2), health and welfare (B.3.1.b Diseases associated with housing conditions and B.3.3.b. Perception of neighbourhood conditions) and housing stock (D.1.1). Some responses described under human settlement policies and programmes, such as human settlements development (C.1.a, b) and self-help programmes (C.1.c), are also relevant to marginal conditions in human settlements.

32. The **periodicity** of data collection and presentation is another general issue of human settlements statistics. In principle, statistics are proposed for annual presentation. However, environmental data are collected over a variety of time periods, ranging from decades in some major censuses to monthly, daily, hourly or even continual monitoring. An important task of data compilation is therefore to process these data for annual presentation. However, this does not preclude the display of monthly or daily data where seasonal or other fluctuations are particularly relevant. For these cases, the periodicity of data presentation is explicitly indicated. In other cases, annual data might be desirable but are not available due to the periodicity of (infrequent) censuses or surveys.

33. A distinct feature of human settlements statistics is the large variety of **data sources**, such as censuses, surveys, administrative records of municipalities, remote sensing or monitoring networks. Base line statistics, which are typically collected by statistical offices in population and housing censuses and surveys, and in industrial, construction and transport surveys, contribute significantly to human settlements statistics. Other data are less routinely compiled in ad hoc surveys of, for example, the quality of life, marginal settlements or public health and sanitation. Statistical offices may be responsible for conducting such surveys, but frequently they are also carried out by ministries, executive agencies or research institutes.

34. Other data collection activities are generally outside the scope of activities of central statistical services. A case in point is **pollution monitoring.** Monitoring data usually need to be further processed for presentation in statistical compendia or other forms of data dissemination. Monitoring data are point-source data which, in the case of human settlements, do not reflect impacts on such areas as the neighbourhood, the city, its hinterland or on the inhabitants of these areas. As yet, there seem to be no general models or procedures that could be widely recommended for turning point-source data into meaningful areal information (see para. 85, below). Therefore, most monitoring data cannot yet be related unambiguously to the socio-economic base line statistics mentioned above. More research on this central aspect of the environment-human settlements relationship is needed.

II. CONCEPTS AND METHODS OF HUMAN SETTLEMENTS STATISTICS

A. Social and economic activities, natural events

35. Socio-economic activities that have an impact on the human settlements environment are broken down into two categories, A.1, Settlements growth and change and A.2, Other activities. The first category relates directly to the construction or use of the elements of human settlements. The second includes emission and waste discharge which occur in connection with socio-economic activities but are not the objective of these activities. They are considered to be at the origin of a sequence of polluting activities and their impacts, consisting of the discharge of pollutants (A.2.1), their ambient concentration in environmental media (B.2.1) and exposure and contamination (including health effects) of biota (B.2.2 and B.3.1). Hazardous activities at the workplace are also shown under "other activities" but are not further elaborated upon in the present report (see A.2.2).

36. Distinct from socio-economic and related activities are extreme natural events (A.3), such as earthquakes, landslides, hurricanes or floods. These events are brought about by natural forces and are thus largely independent from human behaviour. However, human activities frequently contribute to natural disasters through such activities as deforestation or construction of buildings in hazardous areas. As shown in section B below, the impacts of natural disasters on human settlements include damage and destruction of shelter and infrastructure as well as death and injury.

A.1 Settlements growth and change

A.1.1 Population growth and change

37. Variations in population size in a given area are due to two major demographic activities - population growth and migration among settlements - both of which strongly influence the need for shelter, infrastructure and services. Even though migration can be considered a factor of population growth, it is presented as a separate variable because of its significant and sometimes unexpected impact upon the rates of population change in urban and rural settlements. In particular, migration has placed pressures on metropolitan centres through rapid and unplanned urbanization. The contribution by migrants to "informal sector" activities and economic development have been stressed in more recent analyses of urbanization processes. 19/

38. The variables selected for population growth and change are shown in the text table. Variable (a), the average rate of change in population size, is a standard demographic indicator, usually measured as the exponential average annual rate of population growth. The net migration rate, variable (b), is a measure of the difference between gross immigration and gross emigration per 1,000 of the mid-year population. Both variables should be classified by major cities and settlements by population size (see paras. 27 and 28) in order to asses urbanization trends and to pinpoint those settlements that experience rapid change.

VARIABLES (Unit of measurement)	CLASSIFICATIONS
a. Average rate of change in population size (per cent)	
b. Net migration rate (per thousand)	

39. Demographic data are generally collected in population censuses and population and housing surveys. They are also obtained through demographic projections and estimations.

A.1.2 Construction of shelter and infrastructure

40. Construction activities are one of the major factors in distinguishing between the "man-made" and "natural" environment. Their impacts on the natural environment are presented in the report on statistics of the natural environment (in preparation). With respect to human settlements, construction activities affect in particular land use, settlement density, the availability and quality of housing, utilities and infrastructure and other aspects of the human quality of life. Construction may also take place in response to deteriorating living conditions in human settlements, as shown in section C.1. Distinguishing clearly between the present "impacting" activities and those "responsive" to environmental impacts may thus be difficult. Construction also plays a significant role in a nation's fixed capital formation as illustrated by an indicator of the "background" economic situation (D.3.3.d). Besides new constructions, other activities affect changes in the stock of shelter and infrastructure: demolitions, conversions and restoration, as well as destruction by natural disasters or armed conflicts.

41. The statistical variables are distinguished by three major outputs of construction: residential buildings, non-residential buildings and civil engineering projects of infrastructure construction.

VARIABLES (Unit of measurement)	CLASSIFICATIONS
a. Housing units (number)	Structural type of housing units Type of building activity Type of investor
b. Collective living quarters other than housing units (number)	Category of collective living quarter Type of building activity
c. Residential and non-residential buildings (number)	Type of building
d. Decrease in housing stock (number)	Category of living quarters Reason for decrease in stock
e. Civil engineering construction projects (number of projects, kilometres of roads and railroads and other units of project size)	Type of physical infrastructure

42. For residential buildings, the basic variable is the living quarter which consists of housing units (variable (a)) and collective living quarters (variable (b)). Marginal housing units are a particularly important aspect of human settlements and are therefore identified as a separate classification category (see annex A.1.2.a). However, very limited data is available on the construction of such units. As an alternative, changes in the stock of marginal housing units could be used (see annex D.1.1.a). The classification of housing units constructed is taken from the Principles and Recommendations for Population and Housing Censuses 20/ which have been established for the collection and dissemination of statistical data pertaining, at a specific point in time, to all living quarters and occupants. This classification has been used, since there is no internationally agreed classification for current housing (construction) statistics, which are collected and published at least as frequently as annually. Existing statistics are generally limited to the authorized construction of dwellings, excluding housing units produced by "informal" and illegal construction.

43. The total number of housing units completed during a given period consists not only of new units but also of units which become available as a result of restoration, extension or conversion of existing units as indicated in a classification by type of building activity. A further classification of housing units constructed by type of investor is suggested, because an increase in the

housing stock depends not only on the technology of construction but also on financial capabilities. The term "investor" refers to the agents on whose account the units are built (irrespective of whether they are owners or not of the land on which the dwellings are built) and not to those actually erecting them.

44. The **"informal sector"** accounts for a great amount of construction in developing countries. It is therefore shown as a separate category in the classification by type of investor. The structure of the informal sector varies considerably among countries and cultures, and no general definition of this sector is advanced here. A general characterization of the sector may be obtained by contrasting it with the "formal sector", stressing in particular:

Ease of entry;

Reliance on indigenous resources;

Family ownership of enterprises;

Small scale of operation;

Labour-intensive and adapted technology;

Skills acquired outside the formal school system;

Unregulated and competitive markets. 21/

45. Collective living quarters (variable (b)), such as hotels, institutions and camps are intended for habitation by large groups of individuals or several households. Such quarters usually have certain common facilities, such as cooking and toilet installations, baths, lounge rooms or dormitories, which are shared by the occupants. The construction of buildings (variable (c)) is included primarily to cover those premises that harbour non-residential activities, such as industry and commerce, education or health. To obtain the net change in the housing stock during a given period, its decrease by conversion and demolition or destruction also has to be taken into consideration. For this reason, variable (d), Decrease in housing stock is included under the statistical topic of the construction of shelter and infrastructure.

46. In accordance with international practice, 22/ the construction of infrastructural facilities is presented in terms of civil engineering projects (variable (e)). The classification by type of infrastructure, proposed in the annex (A.1.2.e), distinguishes between the major infrastructure functions of transportation, energy, communication and sanitation and water development.

47. The principal sources for housing construction data are building permits registered by municipalities, construction surveys and indirect estimates derived from the results of housing censuses and special housing surveys. In general, special housing surveys and reports address additional aspects of housing not covered in housing censuses and often provide intercensal findings for estimates of the number of newly constructed houses. Special surveys will have to be used for the assessment of activities of the informal sector, which is generally not part of the established (registered) construction business.

48. There are no agreed upon international standards of data collection for civil engineering construction projects. Therefore, diverse data sources will have to be utilized in order to obtain data on the different categories of infrastructure. For example, road construction statistics could be obtained from construction

surveys, while water and sewerage system statistics could be extracted from municipal records. Similarly, data sources for estimates of changes in the stock of shelter and infrastructure may include disaster statistics, administrative records for building renovations and demolitions and comparisons of stock data from two or more housing censuses.

A.1.3 Utilities (energy and water supply)

49. The physical components which constitute the environment of human settlements, that is, the superstructures produced by mankind for shelter, and the complex networks designed to deliver or to remove people and goods from the shelter, cannot operate without the basic utilities of water and energy. To a large extent the presence (or absence) of these utilities in human settlements thus determines the quality of a particular settlement. For this reason, the access to these facilities is shown in some detail under the impact information category as a quality aspect of human settlement (see B.1.2). The equipment of housing units with these facilities is shown as a stock category under D.1.1.

50. The text table below lists only overall energy and water supply to human settlements. These activities produce impacts on human settlements through the availability of utilities to households and through pollution effects from the production and use of these utilities (see B.1.2 and B.2.1). Energy and water supply statistics may also assist in modelling materials/energy throughput for particular settlements. The concepts, definitions and classifications for such resource flows and their availability will be presented in a report on statistics of the natural environment (in preparation) as part of natural resource accounting schemes.

VARIABLES (Unit of measurement)	CLASSIFICATIONS
a. Energy supply	(to be presented in a report on statistics of the natural environment - in preparation)
b. Water supply	(to be presented in a report on statistics of the natural environment - in preparation)

A.1.4 Transport

51. The availability of transport facilities is a major factor in urban growth, since it is a pre-condition of the concentration of employment and production within urban areas. Transportation also plays a significant role in the integration of urban and rural development. Concomitant to the development of transportation systems are major environmental impacts in human settlements,

including the alteration of physical patterns of settlements, the accessibility of infrastructure and services, pollution, congestion and traffic accidents.

52. The variables in the table below refer to the traffic situation (variables (a-c)) and to the transportation of passengers and freight (variables (d) and (e)). They have been selected from well-established transport statistics to give an indication of the causes of environmental impacts resulting from the use of particular transport modes and to describe the existing structure and potential for substitution (among the modes) of the national transportation sector. Since traffic and transportation statistics might not always be available for all major cities and selected settlements (though it would be desirable to indicate inner city transport activities), the presentation by region or administrative district is suggested as the second best solution.

VARIABLES (Unit of measurement)	CLASSIFICATIONS
a. Road vehicles in use (number)	Type of land or road vehicle
b. Vessels arriving and departing ports (number, tonnage)	Port cities
c. Air traffic (number of flights)	Major city (name of airport)
d. Passenger transport (number of passengers, passenger kilometres)	Mode of transport Major city
e. Freight transport (tons of freight, ton kilometres)	Mode of transport

53. Data sources include ad hoc and annual transportation surveys and records of registration schemes, vehicles, passengers and goods that are kept by traffic and transportation authorities.

A.1.5 Land use in human settlements

54. Statistics of land use in human settlements provide an indication of the major categories of human activity habitually carried out in different areas of human settlements. Such data describe the geographical distribution of activities to the extent that they are reflected in the character of built-up land. However, the level or intensity of activities cannot be assessed by land use statistics, and other statistics are suggested for this purpose (e.g. construction or transport statistics as described above). Overall land use (focusing on land outside human

settlements) is presented as background information (D.3.1) and is cross-referenced to a report on statistics of the natural environment (in preparation) where general land use statistics are dealt with in detail.

55. The principal variable (a), shown in the table below, is land area by type of land use of built-up and related land, including land used for residence, industry, commerce, transport, communication and recreation. To highlight its significance, marginal settlements area (variable (b)) is shown separately, though it could be presented as a category of the land use classification for variable (a). However, there is neither a generally accepted definition of marginal settlements area nor are there criteria for their unambiguous distinction from other residential areas (see paras. 31 and 32).

VARIABLES (Unit of measurement)	CLASSIFICATIONS
a. Settlement land area (square kilometres)	Type of land use of built-up and related land Major city
b. Area of marginal settlements	

56. Sources of data for settlement land use statistics are to a large extent based upon zoning maps and municipal registration systems, which indicate those portions of land that are utilized for specific activities. With respect to data presentation, initial publications might present data according to surface area at a point in time. Statistics on land use changes can also be presented by using such techniques as "digitized maps" and "overlay mapping".

A.2 Other activities

57. The monitoring of emissions and ambient concentrations has become a focus of international concern, especially through the Global Environmental Monitoring System of the United Nations Environment Programme (UNEP). National statistical offices now aim progressively at providing monitoring data in environment statistics compendia. Indoor emission in work places has also become an important environmental concern, but to date no widely accepted statistical standards are available. This topic as well as other environmental hazards of the "working environment" are therefore not further developed here.

A.2.1 Emission and waste discharge

58. Practically all types of emissions may occur in human settlements and are therefore listed as variables in the text table. Air pollution, by definition, impairs the quality of the air and is thus shown under the environmental component of "atmosphere" in FDES. In the present report, however, air pollution emission

and ambient concentration (except for "background concentrations", which is described in a report on statistics of the natural environment - in preparation) are dealt with under human settlements, because emissions and their impact on air quality and human health and welfare take place predominantly in human settlements. This argument also applies to the discharge of solid waste and noise emission. In the case of noise, the distinction between emission and ambient concentration is less meaningful, however, because of the limited range of noise emission. Noise pollution is therefore discussed under the environmental impact information category (see B.2.1.c). By contrast, both the origin and the impact of water pollution may occur inside or outside human settlements. As most of the pollutants are either carried or deposited in water bodies outside human settlements, they are described in a report on statistics of the natural environment (in preparation).

59. With respect to air pollution emissions (variable (a)), as of yet, there are no internationally agreed upon standards for definitions and methods of data collection. The brief list of pollutants presented as a classification of emissions by type in the annex is based on draft recommendations by the Economic Commission for Europe (ECE) and an analysis of national environment statistics compendia. Emissions included for statistical measurement under A.2.1 of the annex are: sulfur dioxide (from stationary or mobile sources), nitrogen dioxide, particulate matter, lead and gaseous radioactive discharges. A classification of emissions by major settlements and/or regions can only locate the sources of pollution rather than provide an indication of the range or regional impact of air pollutants (see also B.2.1 below).

VARIABLES (Unit of measurement)	CLASSIFICATIONS
a. Air pollution emissions (tons)	Type of pollutant Type of activity
b. Noise emissions	(see B.2.1.d)
c. Waste water and liquid discharges	(to be presented in a report on statistics of the natural environment - in preparation)
d. Solid waste collected (cubic metres, tons)	Type of solid waste

60. Statistics of solid waste generation (variable (d)) measure waste that is neither treated in waste-water treatment plants nor discharged directly into ambient waters or air. Sludge could be classified as either waste water or solid waste since it represents the usually moist accumulated solids resulting from waste water and sludge treatment. Solid waste classifications can be based either on the physical and chemical characteristics of the materials contained in solid waste or the activities that generate solid waste. Due to the difficulty of obtaining data on uncollected (dumped) waste, waste generation is actually measured by solid waste

collected, as indicated in the text table. The classification proposed in the annex represents the major categories of a draft ECE classification of solid wastes.

61. Hazardous waste is an important consideration in waste management and in the formulation of environmental policies. Hazardous wastes have been defined as "wastes which due to their toxic, infectious, radioactive, flammable etc. character pose a substantial actual or potential hazard to human health or living organisms". 23/ So far, there are no generally agreed upon standards or listings of hazardous wastes. At the national level, such wastes should therefore be earmarked in the waste classification according to national legislative specifications.

62. Data sources for air pollution emissions include surveys of polluters, readings from emission control (monitoring) facilities and estimates derived from production or consumption activities. Estimates based on emission factors, relating to particular production or consumption processes, vary with different technologies applied and corresponding input mixes. Such estimates become especially ambiguous if applied to activities that combine different processes as in the case of overall emission factors or broad industries or industry groups. Even when using a direct method of measurement of emissions, 24/ it is important to document the methods of data collection and processing for purposes of data comparability. Solid waste data are typically obtained from ad hoc surveys of selected sources and from statistical records of municipal and private waste disposal and management agencies.

A.2.2 Hazardous activities at workplace

63. The topics relating to indoor pollution and other environmental risks of the "working environment" are not dealt with in the present report because there are unresolved conceptual problems in identifying and defining relevant parameters as well as considerable difficulties in collecting data. Some topics relating to the working environment are listed, however, in order to indicate their place in the FDES structure for possible future development. The present topic would thus deal with those activities that create health effects associated with the working conditions (B.3.1.c, B.3.2.d). As a first step in developing statistics of the working environment, an inventory of industries with particularly hazardous working conditions (D.2.2) could be established.

A.3 Natural events

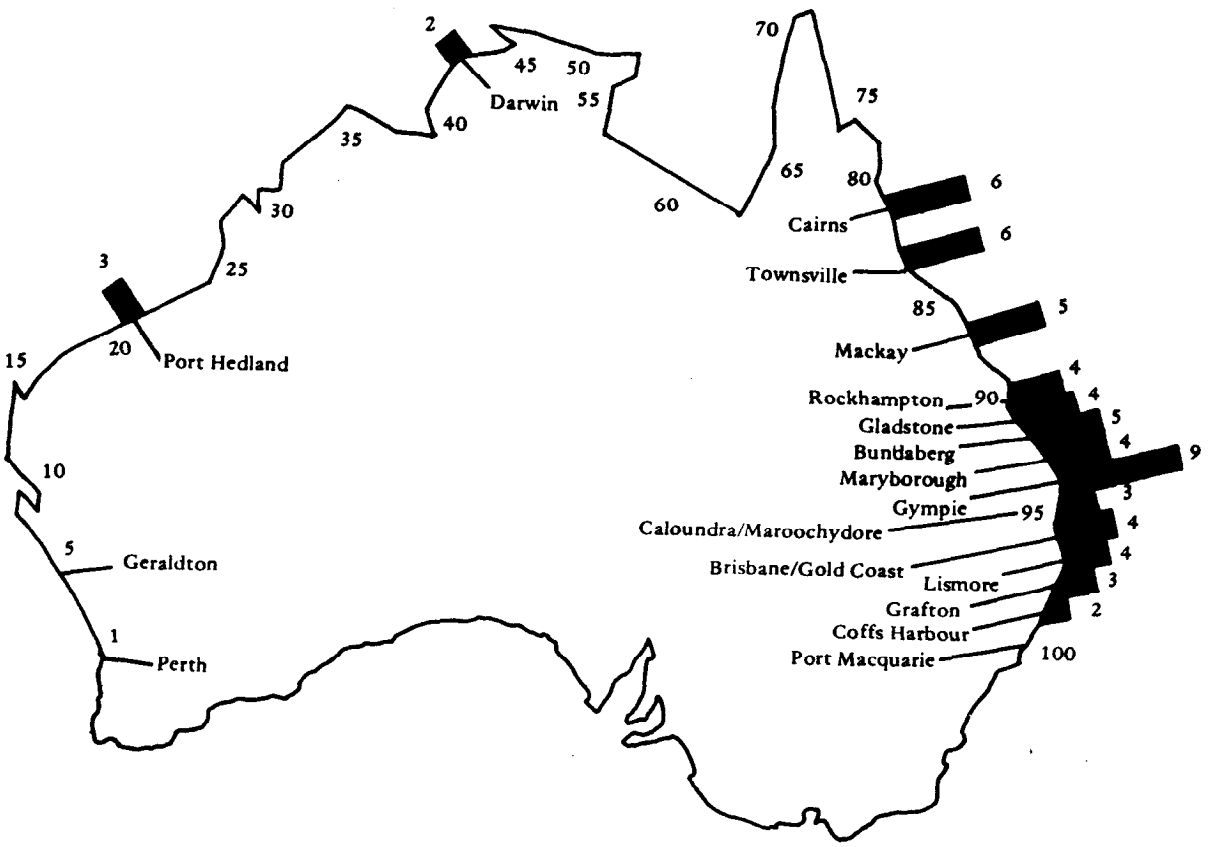
64. Natural events become disasters when they cause fatalities, injuries or damage to property and ecological systems. The occurrence of such events will be described in detail in a report on statistics of the natural environment (in preparation). Variable (a) thus shows occurrence only to the extent that it affects major cities. On the other hand, the impacts of natural disasters on human settlements are of particular concern (see B.3.2.a, b) as the probability of such impacts appears to be increasing due to extended development of human settlements into potentially hazardous areas. A listing of human settlements in such areas is provided as background information (D.2.3).

VARIABLES (Unit of measurement)	CLASSIFICATIONS
a. Occurrence (frequency and magnitude)	Type of natural event City affected

65. Data on natural events are based on a combination of meteorological records and reporting systems for weather and climate hazards and on seismic and geological records for earthquakes and landslides.

66. Graphic presentations of natural events are informative as a way of highlighting the susceptibility of certain urban and rural areas to natural hazards. For example, figure I below shows the number of known cyclone crossings in each of the 100-kilometre units of selected coastlines of Australia.

Figure I. Cyclone occurrence, Australia, 1909 to 1975



Source: Australian Environment Statistics Project, Department of Home Affairs and Environment, Australian Urban Environmental Indicators (Canberra, 1983), p. 284.

Note: Data represent the number of known cyclone crossings in each of the 100 km units of an idealized coastline (there are 100 such units stretching from Perth to Port Macquarie). The number of crossings is greater than the number of cyclones, as a particular cyclone may cross the coast more than once. The data do not include cyclones which approach but do not cross the coastal units. Only crossings for coastal units containing urban areas used in this report are shown.

B. Environmental impacts of activities/events

67. Environmental impacts are the result of socio-economic activities and natural events (see chap. II, sect. A) and responses to impacts (see chap. II, sect. C). They are broken down into three categories. Statistical topics grouped under the first category, "Conditions of shelter, infrastructure and services", relate directly to impacts upon the quantity, quality and distribution of human settlements. Those under the second category, "Conditions of life supporting resources", include ambient concentrations of pollutants and wastes to the extent that they affect human settlements, and the general biological, ecological and microclimatic conditions of settlements. The third category of impacts, "Human health and welfare conditions in human settlements", refers to welfare effects resulting from the physical impacts on human settlements. These effects include diseases and accidents related to the living conditions in human settlements as well as the subjective perception of the environmental aspects of the human quality of life in settlements.

B.1 Conditions of shelter, infrastructure and services

68. This category relates to the three basic components of human settlements: shelter, which includes the superstructures of different shape, size, type and materials erected for security, privacy and protection from the elements and for its singularity within a community; infrastructure, which is the complex network designed to deliver to or remove from the shelter people, goods, energy or information; and services, such as education, health or recreation, which are required by a community for the fulfilment of its functions as a social body (see para. 21 above). The amount of shelter needed is reflected in the housing topic (B.1.1), while the more qualitative aspects of human settlements are dealt with as an issue of access to infrastructure and services (B.1.2). The actual availability of shelter and infrastructure at a specific point in time is presented below as a "stock" item (see D.1.1,2). Urban sprawl and dispersion (B.1.3) are also described as more general consequences of population growth, migration patterns and of related construction activities discussed in the preceding chapter (A.1.1,2).

B.1.1 Housing

69. The housing unit is a physical micro-environment in which most of the human needs and aspirations are met. For this reason, housing is the core concern of human settlements assessment, planning and policies. While quantitative housing needs have generally been met in developed countries, these needs are not met in rural and urban areas in developing countries. 25/ The availability of housing can be assessed from the point of view of the inhabitants by indicators of occupancy and homelessness and from the aspect of accommodation in terms of housing requirements and shortage. The actual housing stock occupied (which can be compared with housing requirements) is described below as a stock variable (D.1.1). Where applicable, the international Principles and Recommendations for Population and Housing Censuses 26/ are used for the definitions and classifications presented in the annex.

70. Variable (a) describes the distribution of inhabitants over various types of living quarters in the classification of housing units and collective living quarters used above (see A.1.2.a,b). Marginal housing units are part of this classification, but different standards and local conditions present particular problems of statistical measurement (see para. 31). Variable (b) is the number of

persons that are without shelter as defined by the cla. .cation of living quarters. Theoretically, the variable measures the difference between the total population and the occupants of the housing stock, but more often the number of homeless persons is assessed by ad hoc surveys conducted in a specific settlement or part of it. The rate of occupancy (variable (c)), measured as the ratio of occupants per room, is an important indicator of the living conditions within the shelter provided. Overcrowding reflects the deterioration of the "indoor environment" and is especially conducive to the spread of communicable diseases. "Overcrowded" describes those living quarters in which the ratio of occupants per room exceeds certain standards. The standards vary according to regions, household size, traditions and the type of living quarter.

VARIABLES (Units of measurement)	CLASSIFICATIONS
a. Occupants of living quarters (number)	Structural type of living quarters
b. Homeless persons (number)	
c. Rate of occupancy (number)	Structural type of living quarters

71. As already mentioned, housing shortages can be assessed by comparing housing stocks and housing requirements. One problem of assessing "housing deficits" in quantitative terms is that they do not reflect qualitative changes in terms of infrastructure and related services. A more complex indicator of housing shortage has therefore been proposed as the difference between the "normative housing requirement" and the existing housing stock. Normative housing requirements, as measured by the indicator "delta" ($\triangle$), are the number of entities that represent "the useful housing solution required to accommodate a household under variable standards, for example, a house, a mobile unit, a natural shelter or a tent." 27/ The standards are set according to particular environmental conditions.

72. For purposes of illustration, table 3 below presents the numbers of delta required for housing a hypothetical population of 1 million inhabitants. The deltas are calculated according to the average size of households (from 2.5 to 6.0 persons per household) and the number of households per delta (from 1 to 5).

73. Information on the population and housing stock is traditionally collected through population and housing censuses. More frequent and detailed, as far as the living conditions in human settlements are concerned, are housing and household surveys, especially if they are tailored to address particular topics.

Table 3. Number of delta required for a population of 1 million

K (Number of households per delta)	Average size of households (hs)							
	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
1.0	400 000	333 333	285 714	250 000	222 222	200 000	181 818	166 667
1.25	320 000	266 666	228 571	200 000	177 778	160 000	145 454	133 334
1.50	266 668	222 220	190 476	166 667	148 148	133 332	121 212	111 111
1.75	228 560	190 476	163 257	142 850	126 984	114 286	103 896	95 239
2.00	200 000	166 667	142 857	125 000	111 111	100 000	90 909	83 334
2.25	177 778	148 148	126 983	111 111	98 765	88 888	80 808	74 074
2.50	160 000	133 333	114 286	100 000	88 889	80 000	72 727	66 667
2.75	141 454	121 212	103 896	90 909	80 807	72 272	66 114	60 606
3.00	133 332	111 111	95 237	83 333	74 074	66 666	60 606	55 555
3.25	123 077	102 563	87 912	76 923	68 376	61 538	55 944	51 282
3.50	114 286	95 237	81 632	71 428	63 492	57 143	51 948	47 618
3.75	106 667	88 889	76 190	66 667	59 259	53 333	48 484	44 445
4.00	100 000	83 333	71 429	62 500	55 556	50 000	45 455	41 667
4.25	94 116	78 431	67 277	58 834	52 288	47 059	42 781	39 216
4.50	88 888	74 074	63 492	55 555	49 383	44 444	40 404	37 037
4.75	84 210	70 173	60 149	52 632	46 784	42 105	38 276	35 088
5.00	80 000	66 667	57 143	50 000	44 444	40 000	36 364	33 333

Source: World Housing Survey 1974 (United Nations publication, Sales No. E.75.IV.8), p. 41.

B.1.2 Access to infrastructure and services

74. Shelter, connected to infrastructure and provided with services, forms the individual settlement at different scales: the dwelling, the building, the neighbourhood, the village, the town, the metropolis. Another kind of infrastructure establishes connections between settlements to form networks of transport and communication at regional, national and international levels. The access to infrastructure and services is, therefore, an important aspect of the quality of human settlements. It is closely related to the construction (A.1.2.a) and the available stock (D.1.2.b) of infrastructure.

75. Variable (a), Settlements supplied with electricity, is a relatively crude overall indicator of a certain level of development (rural development and industrialization) in human settlements. The actual amount of energy provided is listed above as an activity (A.1.3 - cross-referenced to a report on statistics of the natural environment (in preparation), where the consumption of different types of energy is described). The other variables (b)-(g) provide more detail on the access by households to selected infrastructural facilities and services, such as sanitation and transport.

VARIABLES (Units of measurement)	CLASSIFICATIONS
a. Settlements supplied with electricity (number)	
b. Households supplied with water (number)	Distance to water supply Water quality
c. Households with access to the sanitation system (number)	Type of sanitation system
d. Households supplied with electricity (number)	(Will be presented in a report on statistics of the natural environment - in preparation)
e. Households supplied with garbage and refuse disposal (number)	
f. Average distance from home to nearest public transportation system (metres)	
g. Average time spent travelling from home to workplace (minutes)	Type of transport

Other statistics on access to cultural, educational and medical facilities or markets are of interest for a broader assessment of the quality of human settlements. They are not listed in the present report which focuses on environmental aspects. The statistical unit of access variables is the household (supplemented, if available, by population data), while the stock of housing and related facilities refers to the housing unit and is therefore listed under the inventory of shelter and infrastructure category (D.1). The further treatment of refuse and waste water is considered a response to waste discharge and pollution and is presented as pollution control activities (C.2.3).

76. The majority of data shown under B.1.2 are collected in population and housing censuses and household surveys. Municipal records and records of licensing agencies are other sources of information, especially on the availability of community services.

B.1.3 Human settlements sprawl and dispersion

77. Urbanization processes described by variables of population growth and migration (see A.1.1) are responsible for rapidly changing the geographical patterns of human settlements. Urban sprawl is accompanied by rural dispersion, which may inhibit infrastructural development and thus further aggravate rural socio-economic problems. Further impacts on the natural environment, resulting from urban encroachment upon rural areas and from the scattering of rural settlements and homesteads, are quite varied, depending on the particular ecosystems affected. Some of these effects could be dealt with below under B.2.2 (which, however, is not yet developed in the present report); others are to be described in the report on statistics of the natural environment (in preparation). Further analysis of the environmental impacts of changing settlement patterns could be supported by geographical information systems that link the present variables to the distribution of natural resources and land use activities by means of appropriate geographical classifications (geocoding). Changes in land use that are related to changing settlement patterns but do not represent a change in built-up area, such as the drainage of wetlands or the flooding of valley bottoms, are assessed by land use statistics shown here as background variables (D.3.1).

78. The variables selected in the text table illustrate the settlements pattern for a country or region of a country in terms of the concentration of the population in the largest city (variable (a)), of the settlements themselves (variable (b)) and, from a bird's-eye view, as the build-up of land (variable (c)). The role of a high-primacy city (variable (a)) in environmental and human settlements planning and policies may vary according to the climatic and environmental conditions as well as according to the administrative structure of the country. Average distances to primary cities (variable (b)) need to be considered in the context of the available transportation network. Finally, the change of built-up land may be indicative of hazards to natural resources, especially water and vegetation, and ecosystems.

79. According to the nature of the variables, likely data sources are the population and housing census (variable (a)), maps or records from mapping institutions (variable (b)) and municipal records and aerial surveys in the case of assessing land build-up (variable (c)).

VARIABLES (Units of measurement)	CLASSIFICATIONS
a. Primacy rate (per cent)	
b. Average distance from settlements to nearest primary city (kilometres)	
c. Changes in built-up and related land area (square kilometres)	

B.2 Conditions of life-supporting resources

80. The increasing degradation of the life-supporting resources of air, water and land has been identified by Habitat as a major human settlements concern. 28/ Three statistical topics reflect this concern, namely the ambient concentration of pollutants and wastes, biological and ecological impacts in human settlements and human settlement microclimates. However, variables are proposed only for the ambient concentration of pollutants and wastes; the other two topics reflect ecological issues which, in the context of human settlements, require further conceptual clarification 29/ prior to the selection of variables for statistical purposes.

B.2.1 Ambient concentration of pollutants and wastes

81. Ambient concentrations of pollutants in human settlements determine to a large extent the environmental quality in human settlements. They are at the centre of a sequence of pollution-generating activities, impacts and responses, which reflects the basic principle of organization of FDES. Emission and wastes discharge activities (A.2.1) create ambient concentrations of pollutants and wastes (B.2.1) which in turn affect ecological systems (B.2.2) and microclimates (B.2.3) in human settlements and expose the population to contaminants with ensuing health effects (B.3.1); the response to these effects is pollution monitoring and control (C.2). In addition, environmental inventories of emissions (D.2.1) and of hazardous industries (D.2.2) provide the initial specification of those pollutants and their sources that should receive priority in monitoring and control.

82. Air pollution and solid waste are dealt with under human settlements because they represent predominantly a deterioration of the environmental quality of human settlements (see also A.2.1, para. 58). There are, however, two modifications to this approach. Background ambient air pollution measured outside human settlements will be described in a report on statistics of the natural environment (in preparation), and solid waste "concentration" in human settlements is not presented here because of the difficulties of obtaining data on uncontrolled (dumped) waste. Therefore, the present topic presents mainly the concentration of air pollutants in human settlements with cross-references to a report on statistics of the natural environment (in preparation) for acid precipitation and water pollution.

83. Ideally, the concepts, definitions and classifications of pollutants applied in monitoring the above-described sequence of pollution and pollution control should be the same at all stages. However, different methods of measurement and differences in the extent of emission and concentration monitoring and in the environmental characteristics of the area in which monitoring stations are located make the application of common concepts and classifications difficult. A shorter list of air pollutants is thus suggested for emissions (see A.2.1.a) than for ambient concentrations (B.2.1.a), since techniques for the measurement of ambient concentrations are more established than those of emission monitoring.

84. Monitoring networks are usually set up and managed by agencies other than statistical offices. Therefore, the actual measurement (monitoring) of pollutants is generally not considered a task for statistical offices. However, "to the extent that certain statistics can be defined on these data collected elsewhere, statistical offices might be involved in the compilation phase for air pollution statistics". 30/

85. Most environment statistics compendia now include monitoring data aiming at a presentation that permits some linkage to other socio-economic information. One way to achieve this linkage is to "generalize" point-source monitoring data into "impact area" information for which selected socio-economic statistics could also be presented. However, statistical techniques for aggregating data collected at monitoring stations into real estimates of air pollution levels for the area of human settlements or surrounding regions are not yet sufficiently developed to be generally recommended. Variations in the levels of ambient air quality of human settlements depend upon the "distribution of emission sources as well as their strength and height above ground, and the metereological factors (for example, wind speed and direction, presence of temperature inversions and chemical transformation)". 31/ Spatial patterns of air pollution thus vary significantly across cities and industrialized areas.

86. Two types of variables are shown in the text table, namely ambient concentrations of selected pollutants (variables (a), (c), (e)) and the number of monitoring stations which report concentrations within certain classes, including an open-ended "class" containing concentrations that exceed national standards (variables (b) and (d)). The pollutants selected in the classification by type of pollutant are a subset of an ECE classification. 32/ They are sulphur dioxide, nitrogen dioxide, ozone, hydrocarbons, carbon monoxide, lead and particulate suspended matter.

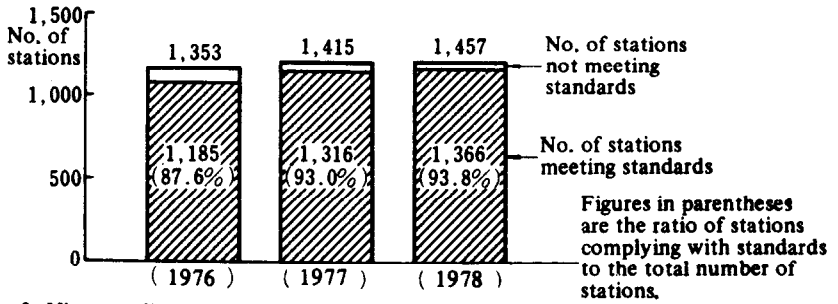
VARIABLES (Unit of measurement)	CLASSIFICATIONS
a. Ambient concentration of air pollutants (micrograms per cubic metre	Type of pollutant Location of monitoring stations
b. Air monitoring stations (number)	Classes of ambient concentrations Type of pollutant Location of monitoring stations Type of area
c. Concentrations in acid precipitation	(Will be presented in a report on statistics of the natural environment - in preparation)
d. Noise monitoring stations (number)	Classes of noise levels Location of monitoring stations
e. Ambient concentration of water pollutants	(Will be presented in a report on statistics of the natural environment - in preparation)

87. For the purposes of assessing diurnal or seasonal fluctuations, hourly, daily and monthly averages of ambient concentrations have to be calculated. For measuring longer-term trends, continuous data series have to cover at least three years. Frequent measurements and their processing are costly, however, and when choosing the periodicity of data recording and collection, these constraints as well as the major purposes of monitoring should be taken into consideration. Early warning systems, for example, need continuous measurement. For annual indicators, measurements from all seasons are needed, with the number of measurements depending on the desired accuracy. For monthly measurements, at least eight samples of 24-hour means have been suggested. 33/ The calculation of the annual arithmetic mean based on this 24-hour average is recommended in the annex for variable (a). Typical statistical measures applied to "condense" the vast amount of data produced by modern monitoring and processing techniques are the median, the arithmetic mean and percentiles of cumulative frequency distributions.

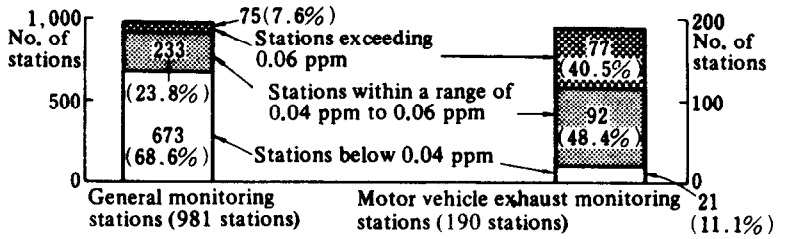
88. In evaluating ambient concentration, excess pollution in the air is recorded through reference to ambient concentration standards. Variable (b) lists air monitoring stations complying with or exceeding national standards by reporting concentrations within certain ranges (compare figure II below) and classifies them by type of area (industrial, residential or commercial) and by type of pollutants. Similarly, the number of noise monitoring stations, which report compliance or exceeding of standards of noise levels within certain ranges (of decibels on the A-scale) are shown as variable (d). Since the degree of disturbance by noise depends on the individual appreciation of different noise sources, the perception of noisiness of the dwelling area is suggested as a further indicator of noise below (B.3.3.d). Environmental standards for air pollution concentrations are discussed below as a response variable of pollution control (see C.2.1.b).

Figure II. Status of compliance with environmental standards relating to air pollution, Japan

1. Sulfur dioxide (Number of general monitoring stations and stations meeting standards)



2. Nitrogen dioxide (results of monitoring in general monitoring stations and automobile exhaust monitoring stations in 1978.)

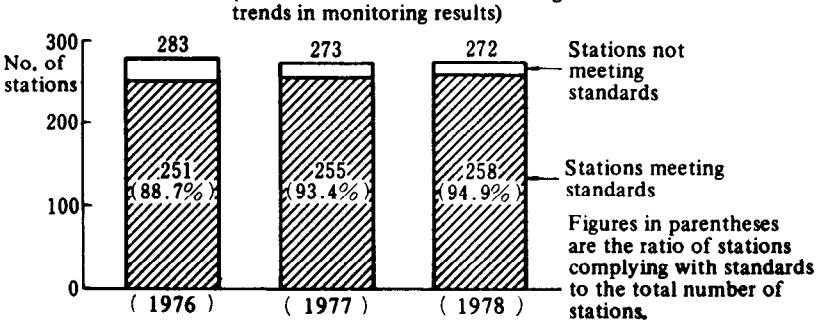


Notes: 1. Motor vehicle exhaust monitoring station figures exclude monitoring stations set on the roadway.

2. Figures in parentheses are the ratio of each category of station to the total.

3. Concentrations are the daily average value for 98 percent of the year.

3. Carbon monoxide (Motor vehicle exhaust monitoring stations and trends in monitoring results)



Source: Environment agency, Japan, Quality of the Environment in Japan 1980, p. 6.

Notes: 1. Motor vehicle exhaust monitoring station figures exclude monitoring stations set on the roadway.

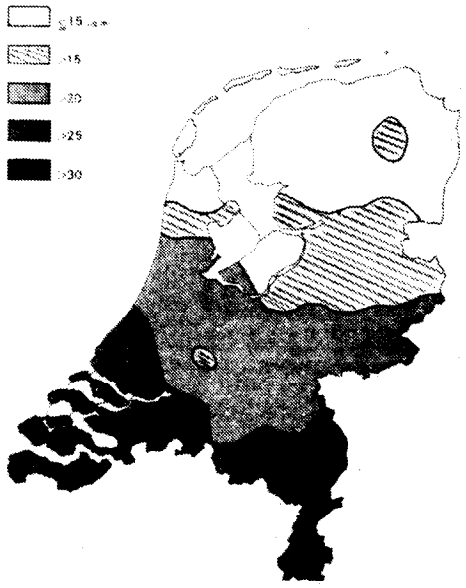
2. Figures in parentheses are the ratio of each category of station to the total.

3. Concentrations are the daily average value of 98 per cent of the year.

89. Air monitoring networks and noise monitoring stations provide data on ambient concentration and noise levels. Measurement and recording methods may vary among different monitoring stations, which impairs inter-station or cross-regional comparisons. Standard methods of measurement of air pollution concentrations are being established by the World Health Organization (WHO), the World Meteorological Organization (WMO) and the International Organization for Standardization (ISO). 34/ Standardized measurement of air pollution will eventually improve the estimation of areal impact data to provide meaningful averages for the whole or parts of a settlement.

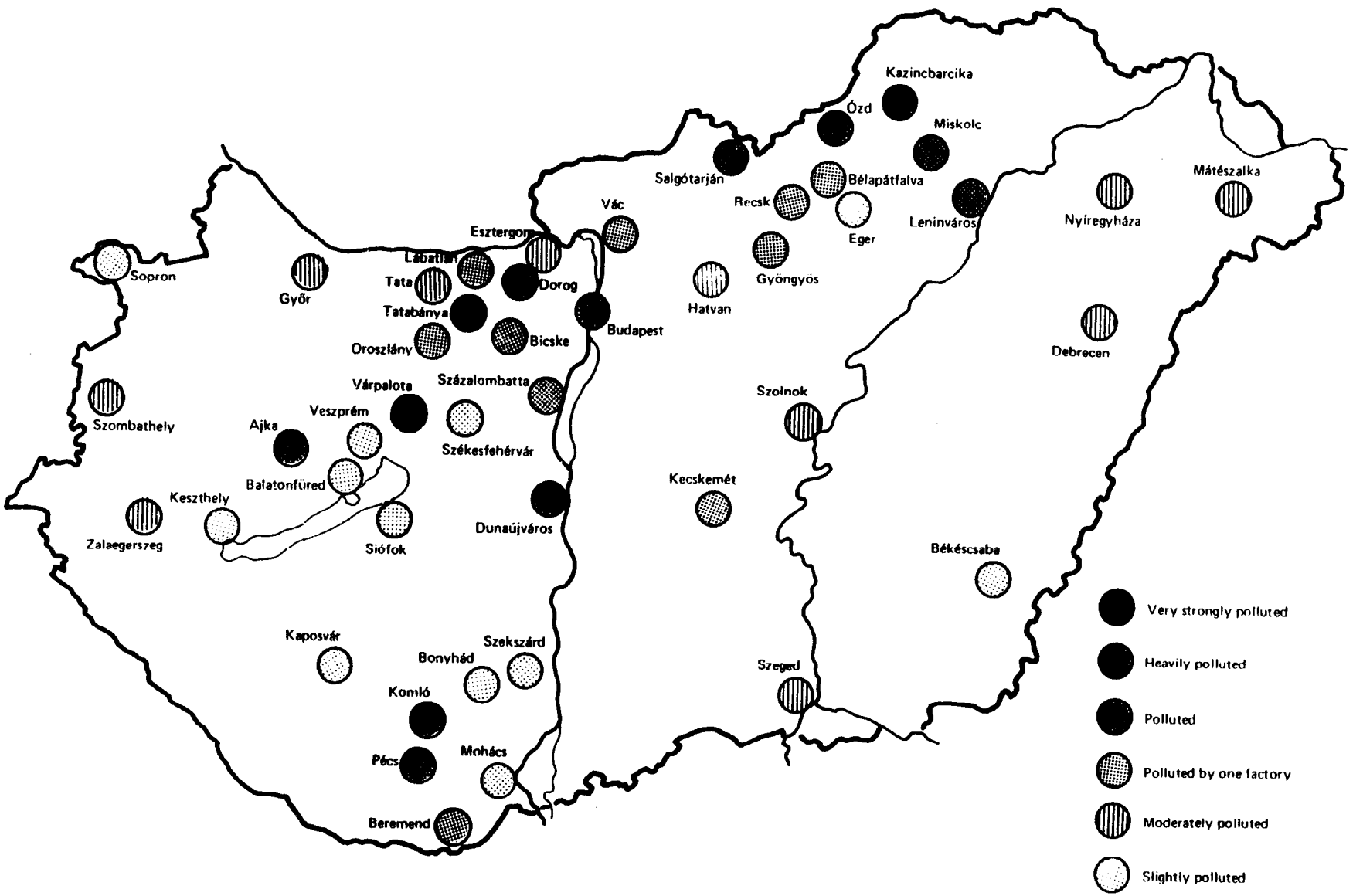
90. Methods for presenting air monitoring data may also vary widely, ranging from daily averages of ambient concentrations displayed in tables, graphs or histogrammes to the presentation of spatial patterns in isopleth maps, the combination of meteorological and air pollution data in "air pollution roses" 35/ or the calculation of complex air pollution indices which combine concentration data for different pollutants. The Pollution Standard Index (PSI) used in the United States is an example of the latter. The index is based on the level of concentration of five major air pollutants and is computed on a daily basis in most metropolitan areas for early warnings of health hazards. 36/ The following examples of presentation show the status of compliance of monitoring stations with air pollution standards in Japan (figure II), an isopleth map of sulphur dioxide concentrations in the Netherlands (figure III) and the presentation of an air quality index in a map of settlements in Hungary (figure IV).

Figure III. Sulphur dioxide in air, 1984/85, Netherlands



Source: Centraal bureau voor de statistiek, Algemene milieustatistiek 1983-1985 (S'Gravenhage, 1986), p. 208.

Figure IV. Air pollution of the settlements between 1976-1980, Hungary



Source: Hungarian Central Statistical Office, Environment Statistics 1975-1980, (Budapest, 1981), figure 4.

B.2.2 Biological and ecological impacts

91. The assessment of ecological impacts in human settlements is still more a subject of research than of routine data collection. The topic is therefore not proposed in the present report as an issue to be addressed by official statistics. On the other hand, the presentation of the topic within the framework format of this report might point out useful "base line" data for the ecological study of human settlements, shown under other statistical topics (for example, A.1.4, Energy and water supply or B.2.1, Ambient concentrations of pollutants and wastes).

B.2.3 Microclimates

92. Microclimatic impacts are especially relevant for the assessment of ecological impacts in human settlements - a topic that is not further developed here (see B.2.2). Climatic patterns, however, are included as a "background" topic (D.3.4).

B.3 Health and welfare conditions in human settlements

93. Statistical topics covered under human health and welfare refer to the effects upon the health and welfare of individuals resulting from the environmental impacts on man-made (B.1) and natural (B.2) components of human settlements discussed above. The topics include selected aspects of exposure and disease in human settlements (B.3.1), settlement-related damage and accidents (B.3.2) and some indicators on the perception of the quality of life in human settlements (B.3.3).

B.3.1 Exposure and health effects

94. The present topic provides the links between the above-described pollution statistics (B.2.1) and low-quality (marginal) living conditions (B.1.1,2) with their potentially adverse effects on human health. The links can be described as a sequence of exposure of certain groups of people to ambient concentrations of pollutants, the dose of the pollutant received and the health effects resulting from the intake of the pollutant. Exposure information can be obtained by air pollution monitoring devices measuring individual or sample population group exposure, or by means of estimation models. 37/ Such information is not proposed for compilation and dissemination by statistical offices, since it is more the result of *ad hoc* research and assessment studies than of routine data collection. Similarly, health effects of living conditions and pollution are presented only by the proxy measure of the incidence of those diseases that are considered to be caused at least in part by human settlements conditions.

95. The variables shown in the text table thus describe only selected aspects of exposure and related diseases, based mainly on criteria of data availability. No attempt is made to assess actual cause-effect relationships. Contamination statistics will be shown in a report on statistics of the natural environment (in preparation). Work-related effects of exposure and contamination, for example, with asbestos, should be included under a classification of diseases associated with working conditions, which is however not developed in the present report (see A.2.2).

96. Variable (a) assesses the proportion of the population affected adversely by noise. After recording the noise levels exceeding national standards (see B.2.1.d) by city area, estimates of the population experiencing excessive noise levels in those areas can be made. Variable (b) provides incidence rates of diseases

associated with housing conditions, that is, communicable and infectious diseases. Incidence rates may be difficult to estimate, and mortality rates (by cause of death) could be compiled as an alternative. As already mentioned, diseases related to the working environment (variable (c)) are not presented here, while those related to water use (variable (d)) will be shown in a report on statistics of the natural environment (in preparation).

VARIABLES (Unit of measurement)	CLASSIFICATIONS
a. Population exposed to excessive noise (number, per cent)	Selected city areas
b. Diseases associated with housing conditions (number per 100,000 population)	Type of disease
c. Diseases associated with working conditions	(see A.2.2)
d. Water-borne and water-related diseases	(Will be presented in a report on statistics of the natural environment - in preparation)

97. The data sources for variable (a). Population exposed to excessive noise levels, are largely derived from the findings of noise monitoring stations, which report noise levels found in selected areas and from demographic surveys, which indicate the population sizes of areas experiencing excessive noise. Sources of data on environmental diseases include the research of epidemiologists, epidemiological surveys and annual health reports of health and labour ministries and other concerned agencies.

B.3.2 Settlement-related damage and accidents

98. Settlement-related damage refers to the impact of natural disasters (A.3) on shelter and infrastructure. Environment-related accidents in human settlements result in human injury and loss of life and are distinguished according to cause by natural disaster, by traffic or in connection with industrial activities.

99. Variable (a) measures shelter and infrastructure damaged or destroyed by natural disasters. The classification by causes of damage is by the type of natural events presented for variable A.3.a (adding "fire" as an additional category). A similar continuity in the classification across the information categories is also maintained for the type of shelter and infrastructure, presented under A.1.2.a, b and c. In this manner, greater comparability of variables is achieved for further (correlational) analysis. In addition to the estimates of physical damage (in terms of the number of living quarters, buildings and infrastructure projects and the length of roads and railroads), the calculation of damage costs is also suggested by variable (a).

VARIABLES (Unit of measurement)	CLASSIFICATIONS
a. Shelter and infrastructure damaged or destroyed by natural disasters (number, kilometres, monetary unit)	Cause of damage Type of shelter and infrastructure
b. Injury and loss of life from natural disasters (rate per 100,000 population)	Cause of injury or loss of life
c. Injury and loss of life from road traffic accidents (number)	
d. Injury and loss of life from industrial accidents (number)	Agency of accident Type of industry

100. Environment-related human injury and loss of life in human settlements are measured by three variables, according to their causes: natural disaster (b), road traffic accidents (c) and industrial accidents (d). Injuries and loss of life from disaster (b) are partly the consequence of the severity of the natural event, the degree to which it touches heavily populated human settlements areas and partly the consequence of preventive actions taken to reduce the impact of natural disaster upon buildings, infrastructure and human health through disaster planning. Injuries and loss of life from disaster are classified by cause, using the same classification described under variable (a) for cause of damage. Road traffic accidents are covered under this statistical topic because they are strongly affected by the amount and quality of transport infrastructure and services available in and between human settlements. Industrial accidents (d) are classified by type of industry and by the agent of injury. The classification of industrial accidents resulting in injury and death by agent of injury follows the recommendations of the WHO international classification of diseases.

101. Data sources for statistical variables of settlement-related damage and accidents vary greatly. For example, disaster records are kept for emergency operations and for disaster-related claims. Special research studies on meteorological or geological events that became disasters are also used as data sources. Transport agencies report on transport safety records of cities or regions and compile police records and other administrative sources into statistics of the total number of deaths and injuries from accidents. Reports of industrial accidents are compiled by industrial health surveys, annual labour force surveys and by insurance companies and benefit organizations, such as social security and disability benefits programmes and national health schemes. Departments of labour compile and present data from these sources in order to record the frequency and severity of industrial accidents by type of industry.

B.3.3 Perception of the quality of life in human settlements

102. The objective conditions of human settlements as described by the preceding statistical topics (B.1 and 2) determine to a great extent the subjective perception of the quality of life. The improvement of the human quality of life has been considered as "a prerequisite for the full satisfaction of basic needs, such as employment, housing, health services, education and recreation". 38/ In the Report of Habitat the quality of life is assessed according to the opinions and reports of persons residing in settlements. The subjective evaluation of the immediate physical environment of the dwelling and neighbourhood is probably the closest that can be achieved in measuring the quality of life or welfare aspect of human settlements. 39/

103. Variables include measures of the perceived quality of home conditions (variable (a)), of the nearby settlement environment (variable (b)), of neighbourhood services (variable (c)) and evaluations of near-home noise levels (variable (d)). The variables are qualitative, that is, they measure selected aspects of the quality of life on evaluative scales, such as ratings (from excellent to poor) or on dichotomous scales (yes/no responses). The classifications proposed for these variables are based on findings from national environment statistics compendia and do not stem from international recommendations or guidelines. They are subject to modification, depending upon the further development of environment statistics and the formulation of survey questions on the perception of the quality of life in settlements.

VARIABLES (Unit of measurement)	CLASSIFICATIONS
a. Perceptions of housing unit (number, per cent)	Rating Age group of respondent
b. Perceptions of neighbourhood conditions (number, per cent)	Rating Type of environmental condition Age group of respondent
c. Perception of neighbourhood services (number, per cent)	Rating Type of service Age group of respondent
d. Perceptions of noisiness of dwelling area (number, per cent)	Categories of noisiness of dwelling area Primary source of noise

104. The perceptions of respondents of the quality of life can be assessed by ad hoc quality of life surveys or sample surveys of health, the labour force, environment and transport. Responses to survey questions are usually presented as percentage distributions of survey respondents who reported a particular condition or opinion. An example of how survey data on perceptions of the noisiness of the dwelling area can be presented in a statistical compendium is shown in table 4 below.

Table 4. Noisiness of dwellings according to inhabitants, Hungary

(Per cent)

	Silent	Appropriate	Noisy	Very noisy	Total
Budapest	34	37	23	6	100
Towns	37	43	17	3	100
Villages	53	38	8	1	100
Total country	44	39	14	3	100

Source: Hungarian Central Statistical Office, Environmental Statistics 1975-1980 (Budapest, 1981), table 5.1.6, p. 42.

C. Responses to environmental impacts

105. This information category of the FDES has been designed to review the responses of individuals, social groups, non-governmental organizations and public authorities to environmental impacts of human activities and natural events upon human settlements. Responses include the development and implementation of human settlements policies and programmes (C.1), pollution monitoring and control in human settlements (C.2) and prevention and relief programmes for natural disasters (C.3).

106. Response variables do not lend themselves to statistical presentation in the same way that activity and impact variables do. Part of the problem is that policies and legislation are more qualitative than quantitative in nature. However, standards and regulations are frequently listed in environment statistics compendia as a means of controlling and evaluating pollution impacts in human settlements. Alternatively, an estimate of the willingness to respond to environmental impacts can also be obtained by measuring financial allocations to environment and settlement programmes and projects.

C.1 Human settlements policies and programmes

107. Human settlements planning and policy are essential components of national and regional development policy as evidenced by the high shares of capital formation in buildings and infrastructure (see D.3.3.d). They are the direct response to inadequacies in the stock and quality of shelter, infrastructure and services. The data presented under this topic are used to assist in the formulation and evaluation of integrated planning and policy (see paras. 20, 22 and 25). However, as already pointed out (see A.1.2), it is difficult to distinguish clearly between policies and programmes that are responses to deteriorating living conditions and other activities, since most human activities could probably be considered as some form of response to social, economic and environmental conditions. The variables presented here are thus relatively eclectic and do not represent as distinct a response category as, for example, pollution monitoring and control (C.2).

108. Expenditures for human settlements development, that is, the financial resources allocated and spent for the improvement of human settlements conditions (variable (a)), refer to both budgetary allocations and actual expenditures for which investments and running costs should be recorded. Theoretically, only outlays for responses to environmental impacts, such as the establishment of green zones in inner cities, should be included. However, the borderline between environmental and socio-economic programmes and activities cannot always be clearly drawn, especially in the case of "integrated" programmes which combine social, economic and environmental objectives. Thus the classification by type of programme makes no distinction between environmental and non-environmental settlements policies and programmes but refers only to the three broad categories of housing, land development and infrastructure.

109. Self-help housing and community development programmes (variables (b) and (c)) are an important response to housing concerns, especially in "marginal" settlements and as part of "informal sector" activities (see also A.1.2). 40/ Variable (c) is shown here as a response, though it should also be included under the construction topic of section A (see A.1.2.a). The number of housing units constructed in such programmes are classified according to the technology applied. Community development programmes are characterized by the type and degree of participation.

VARIABLES (Unit of measurement)	CLASSIFICATIONS
a. Expenditure for human settlements development (monetary unit)	Type of programme Source of expenditure Type of expenditure
b. Community development programmes (number)	Type of participation
c. Self-help housing units constructed (number)	Construction technologies
d. Violations of building codes and regulations prosecuted (number)	Type of violation
e. Settlements area under land use regulation (square kilometres)	Type of regulation (zoning)
f. Historic sites preserved (number)	Type of historic site

110. The control of building construction and the establishment of building codes (variable (d)) are a response to the need of meeting established standards. A measure of the enforcement of codes and regulations is the number of violations prosecuted classified by type. Land policies and land zoning are important instruments for resolving conflicting land uses, such as industrial, environmental or recreational purposes. Variable (e) is to register the land area for which land use is restricted according to national regulations. The number of historic sites preserved (variable (f)) is an indicator of the protection of the cultural patrimony. Historic sites are defined according to national criteria; no generally applicable classification is available to date.

111. Capital expenditures are compiled in national accounts, however not always in the breakdown desired for environmental purposes. Preliminary budgetary information from governmental development plans is more programme-oriented but usually excludes private activities. Municipal records are the most important source for land use and building regulations and the identification of historic sites.

C.2 Pollution monitoring and control

112. Pollution monitoring and control is a direct response to pollution and waste discharge in human settlements. As in the case of emissions (A.2.1) and ambient concentrations (B.2.1), the focus here is on responses to air pollution and solid waste generation. Responses include the setting of standards (C.2.1), the establishment of monitoring networks (C.2.2) and the treatment and reuse of solid wastes (C.2.3).

C.2.1 Standards, regulations and violations

113. Standards and regulations of pollution emissions and concentration levels are designed for use by monitoring stations and controlling agencies to assess whether organizations or individuals are violating certain levels of pollution emissions in their socio-economic activities, and also to determine whether emissions have reached a dangerous level of concentration. Standards may be based upon international, national or municipal laws or guidelines concerning acceptable levels of emissions or concentrations. Frequently, standards are listed and described in "environmental inventories" (D.2.1).

114. For emission standards of air pollutants (variable (a)), the same classification of type of pollutant laid out for variable A.2.1.a, Air pollution emissions, is used. Similarly, air pollution concentration standards (variable (b)) refer to air pollutants in the same classification by type of pollutants used for variable B.2.1.a, Ambient concentration of air pollutants. Variable (d), Solid waste treatment and removal standards, is classified by type of solid waste as is variable A.2.1.d, Solid waste collected. In this manner, emissions and concentrations can be directly linked to their respective environmental standards.

VARIABLES (Unit of measurement)	CLASSIFICATIONS
a. Air pollution emission standards (number of parts per measured unit, db/A)	Type of activity Type of pollutant
b. Air pollution concentration standards (micrograms per cubic metre)	Type of pollutant
c. Water pollution standards	(To be presented in a report on statistics of the natural environment - in preparation)
d. Solid waste treatment and and removal standards	Type of solid waste

115. Data sources for standards are varied and are based upon legislative records and the reports of regulatory bodies, such as environment or transport agencies. An example of how standards and changes in standards can be presented is provided in table 5.

Table 5. Emission standards for new automobiles, United States of America

(grammes per mile)

Year	Hydrocarbons	Carbon monoxide	Nitrogen oxides
1957-1967	8.7	87.0	4.0
1970	4.1	34.0	..
1975	1.5	15.0	3.1
1980	0.4	7.0	1.0
1981-1985	0.4	3.4	1.0

Source: Supporting Data for Environmental Trends, U.S. Geological Survey, Open-File Report 83-534, p. 60.

C.2.2 Monitoring

116. Air quality monitoring is a major response to deteriorating air quality in urban-industrial areas. Monitoring stations are designed to assess whether health standards of air quality are exceeded, to warn the public of health risks and to institute regulatory action against violation of environmental standards by industry, individuals and other groups.

117. Statistics on the location of monitoring stations (variable (a)) assist in the interpretation and evaluation of monitoring data, especially regarding their areal representativeness. Generic standards for the location of monitoring stations are being developed in some countries. 41/ Some of the criteria currently used for locating measurement stations refer to the objectives of monitoring, the need for monitoring certain industries or industrial areas, the degree of comparability required in the estimates, the period and frequency of measurement intended and weather and climate conditions.

118. Besides being an indicator of the health situation in human settlements, the number of days with health warnings (variable (b)) indicates the extent to which monitoring networks provide information on the environmental safety of settlements with respect to pollution. The classification of health warnings is by type of warning, such as air, freshwater or other pollution. Variable (c) measures the number of violations and regulatory actions instituted by type of action. This variable provides an indication of the extent of immediate responses to control pollution and polluting activities.

VARIABLES (Unit of measurement)	CLASSIFICATIONS
a. Monitoring stations (number)	Type of pollutant monitored Location of monitoring stations
b. Days with health warnings (number)	Type of health warnings
c. Violations prosecuted and regulatory actions (number)	Environmental area Type of action

119. Data sources for monitoring and controlling pollution are derived from the administrative records of enforcement agencies, reports of air monitoring networks and the reports of regulatory bodies responsible for the quality of the environment. Table 6 gives an illustration of how to present an overview of the monitoring network in a country in tabular format.

Table 6. Number of cities and air monitoring stations by type of pollutant monitored, Japan

TYPE OF POLLUTANT	1969	1970	1971	1972	1973	1974	1975
Sulfur dioxide							
Number of cities	93	144	206	285	379	453	503
Number of stations	251	390	599	791	1 071	1 257	1 359
Nitrogen oxides							
Number of cities	12	13	44	112	192	303	385
Number of stations	17	20	68	176	329	582	727

Source: Government of Japan, Planning and Co-ordination Bureau Environment Agency, Environment Statistics Abstract 1979, p. 151.

C.2.3 Treatment, disposal and reuse of discharges

120. Treatment, disposal and reuse of solid waste are three major responses to the build-up and dumping of solid materials onto land and into soil and water. Solid wastes are materials for which the holder has no further use and seeks to dispose of them at the lowest possible cost. Environmental responses attempt to ensure that the disposal is carried out in such a way that it does not seriously damage the environment nor become a health hazard. The materials balance approach to the description of the waste economy has been considered as the ideal way to monitor wastes statistically, and draft guidelines for materials/energy balances were suggested by the Statistical Office of the United Nations. 42/ However, this approach was viewed as too ambitious since most countries lack the necessary statistical capabilities to implement such a system. 43/

121. Variable (a), Waste water treatment, will be cross-referenced to a report on statistics of the natural environment (in preparation) for details on definitions and classifications. It is also included here because the treatment and management of waste water influences the quality of potable water for domestic, industrial and recreational uses in settlement areas. Variable (b), Reuse and recycling of solid waste, is classified by type of materials according to a draft ECE classification of solid wastes. The classification of variable (c), Treatment and disposal of solid waste, is also based upon the ECE classification of solid wastes. The classification distinguishes between the treatment of hazardous and non-hazardous wastes as defined above (see A.2.1, para. 61).

VARIABLES (Unit of measurement)	CLASSIFICATIONS
a. Waste water treatment	(Will be presented in a report on statistics of the natural environment - in preparation)
b. Reuse and recycling of solid waste (tons)	Type of waste reused
c. Treatment and disposal of solid waste	Type of treatment and disposal

122. Data on treatment, reuse and recycling of waste are collected from a number of sources. Reuse and recycling data are taken from trade statistics on commercial transactions, ad hoc waste or industrial surveys and administrative records of waste management authorities. Data on treatment and disposal of solid waste are derived from municipal records of collection and treatment services and ad hoc and annual surveys of industrial waste. Illegal dumping of waste is usually neglected because of the problem of covering activities that are not registered.

C.2.4 Expenditure for pollution control

123. Expenditures for pollution control provide an indication of the degree of commitment shown by Governments and industry to pollution control and waste treatment. However, as already indicated (see para. 107, C.1), it is not always easy to distinguish between expenditures for production or productivity increase and those for pollution control, especially when new (less polluting) production programmes or technologies are installed.

124. Expenditures for pollution control (variable (a)) are classified by type of expenditure, that is, investment or running costs, the type of pollution controlled and by whether the sources of expenditure are private or public.

VARIABLES (Unit of measurement)	CLASSIFICATIONS
a. Expenditure for pollution control (monetary unit)	Type of expenditure Area of expenditure Source of expenditure

125. Data sources for estimates of expenditure on pollution control are national accounts, fiscal reports and development plans and industrial censuses and surveys.

C.3 Prevention and hazard mitigation of natural disaster

126. Impacts on human settlements from natural disasters are influenced by the extent to which they have been anticipated through planning, policy formulation and implementation of prevention and mitigation programmes. Responses to prevent or avoid negative impacts of natural events upon settlements (so that they do not become disasters) and to mitigate the effects of disasters (that did occur) are the subject of this statistical topic.

127. Variable (a) estimates expenditure by government and non-governmental organizations for hazard mitigation and prevention. The classification of expenditures by type of hazard is the classification of type of natural events used in A.3.a and B.3.2.a to facilitate comparisons with disaster occurrence and impacts.

VARIABLES (Unit of measurement)	CLASSIFICATIONS
a. Expenditure for hazard prevention and mitigation (monetary unit)	Type of hazard Source of expenditure

128. Data sources for this topic are fiscal records and national and regional development plans.

D. Stocks, inventories and background conditions

129. Statistical topics in this FDES category are included in order to lend perspective to those in the three other information categories. The topics and variables presented here indicate the links to broader approaches to human settlements statistics, beyond the assessment of the environmental aspects of human settlements. Human settlements stocks, inventories and background conditions include the stocks of shelter and infrastructure (D.1), environmental inventories (D.2) and socio-economic and demographic background variables (D.3).

D.1 Stocks of shelter and infrastructure

130. Stocks of housing and infrastructure, recorded at a particular point in time, provide the base line information for assessing changes in the quantity and quality of shelter and infrastructure (compare B.1). In an accounting approach (such as balance sheets or resource accounts - concerning resource accounts, see a forthcoming report on statistics of the natural environment), information presented under this statistical topic provides the starting and end points of the accounting process by linking stock changes between two points in time to different activities responsible for these changes. If such an approach is not feasible because of conceptual problems and lack of data, a one-time look at the structure and amount of housing and infrastructure still provides a good initial insight into the overall human settlements situation in a country.

D.1.1 Housing stock

131. The housing stock of a settlement includes all the existing living quarters which are structurally separate and independent places of abode. They may have been constructed or converted for human habitation or, although non intended for habitation, actually be in use as such. The housing stock is classified according to internationally agreed upon principles and recommendations for housing censuses. 44/ For comparative reasons, the same classification is proposed to enumerate the output of the construction sector (A.1.2) which affects directly the housing stock. The same classification is also applied to variables measuring the availability of housing, infrastructure and services (B.1.1, 2), where the units of measurement generally refer to the number of persons or households requiring or occupying housing units or having access to infrastructure and services.

132. A complete list of the variables, units of measurement and definitions related to the housing stock is included in the United Nations, Principles and Recommendations for Population and Housing Censuses. The following variables have been selected for their close relation to environmental concerns in human settlements.

VARIABLES (Unit of measurement)	CLASSIFICATIONS
a. Living quarters (number)	Category of living quarters Type of tenure
b. Housing units with toilet facilities (number)	Category of housing units Type of toilet
c. Housing units with water supply system (number)	Category of housing units Type of water supply system Quality of water supplied
d. Housing units with facilities (number)	Category of housing unit Type of facility

133. The primary source of information is the housing census, which has been defined as "the total process of collecting, compiling, evaluating, analyzing and publishing or otherwise disseminating statistical data pertaining, at a specified time, to all living quarters and occupants thereof in a country or in a well-delimited part of a country". 45/

D.1.2 Non-residential buildings and other physical infrastructure

134. The measurement of the stock of infrastructure complements the assessment of the housing stock to obtain a full inventory of built-up land. The stock of infrastructure includes non-residential buildings by type of building (industrial, commercial, educational, health, other) and civil engineering structures by type of physical infrastructure (transportation, energy, communications, sanitation and water-related projects).

VARIABLES (Unit of measurement)	CLASSIFICATIONS
a. Non-residential buildings (number)	Type of non-residential building
b. Civil engineering structures (number)	Type of physical infrastructure

135. The primary sources of information are censuses, construction surveys, constructions records and municipal records.

D.2 Environmental inventories

136. Environmental inventories, as presented here, identify the principal factors that can be held responsible for the deterioration of the environmental quality of the man-made environment and that pose general hazards to this environment. Emission inventories (D.2.1) list those substances and their sources that may generate pollution in human settlements and may thus require monitoring and control (C.2). Hazards of the working environment (D.2.2) stem from indoor pollution or other occupational risks, but this topic is not developed here since its inclusion under environment statistics is controversial. An inventory of potentially hazardous geographical areas (D.2.3) is directly relevant to settlement planning and administration; it will be fully developed in a report on statistics of the natural environment (in preparation) for an overall assessment of vulnerable areas of the natural and man-made environment in a country.

D.2.1 Emissions

137. Emission inventories describe and list pollutants and wastes by source, in anticipation of pollution monitoring and control activities. Where monitoring systems are already established, inventories are used for recurrent reviews of the scope, coverage and standards in response to changing technologies and knowledge about environmental impacts.

138. The three types of inventories presented under this statistical topic refer to (a) air pollutants, (b) water pollutants and (c) solid wastes. Inventories of water pollution will be discussed in a report on statistics of the natural environment (in preparation). The air pollution and solid wastes inventories could be based on international lists of pollutants and wastes, such as those presented in draft ECE classifications. These classifications were developed for purposes of international reporting of environment statistics. They should be useful in both developing national inventories as well as selecting pollutants for monitoring and data dissemination in statistical compendia (see A.2.1 and B.2.1 above).

VARIABLES (Unit of measurement)	CLASSIFICATIONS
a. Air pollutants (listed by name)	Type of activity
b. Water pollutants (listed by name)	(Will be presented in a report on statistics of the natural environment - in preparation)
c. Solid wastes (listed by name)	Source of solid waste

139. A draft standard classification of air pollution 46/ has been proposed by ECE in close co-operation with WHO, WMO and ISO as a "framework for air quality statistics". It is considered as a reference system and a checklist for the practical development of air quality statistics, covering air pollutants and other air characteristics, such as noise, turbidity or odours. The classification is reproduced below for quick reference, but the full text should be consulted for the definition of the major concepts presented in the classification. The most frequently monitored pollutants are marked with an asterisk. Chlorofluorocarbons (CFC 11 and 12) have recently received general attention because of their contribution to ozone depletion and should thus be added as separate items. Shorter lists of pollutants are given as classifications of emissions (A.2.1.a) and ambient concentrations (B.2.1.a) in the annex.

INDICATIVE FRAMEWORK FOR AIR QUALITY STATISTICS

A. Classification of chemical elements and compounds in the atmosphere

* 1. Sulphur oxides and sulphates

2. Other sulphur compounds (both organic and inorganic)

* 3. Nitrogen oxides and oxidants

* 3.1 Nitrogen oxides

* 3.2 Ozone and other oxidants, excluding hydrocarbons

* 4. Carbon monoxide

5. Ammonium compounds

6. Other organic and inorganic compounds

* 6.1 Hydrocarbons

6.1.1 Aliphatic

6.1.2 Aromatic

6.2 Aldehydes

6.3 Organochlorine compounds

6.4 Halocarbons

6.5 Vinyl chloride

6.6 Pesticides

6.7 Fluorides

6.8 Chlorine

6.9 Hydrogen fluoride

6.10 Hydrogen chloride

6.11 Other

7. Trace metals (e.g. lead, arsenic, selenium, mercury, cadmium, chromium, zinc and others as appropriate)

8. Fibres (e.g. asbestos, etc.)

B. Classification of composite characteristics

1. Odours

2. Turbidity

* 3. Particulate matter

3.1 Respirable

3.2 Non-respirable

* 4. Acidifying deposition

4.1 Wet

4.2 Dry

* 5. Radioactivity

* 6. Noise

140. The major categories of the draft ECE standard classification of solid wastes 47/ are shown in the annex for the variable of solid waste collected (A.2.1.d). Particularly important are hazardous wastes (see A.2.1, para. 61) which typically include:

(a) Arsenic and cyanide compounds;

(b) Pesticides;

(c) Chlorinated hydrocarbons (excluding pesticides);

(d) Aromatic hydrocarbons;

(e) Heavy metals;

(f) Radioactive materials.

Hazardous wastes need to be specified in more detail in accordance with national practices and legislation.

141. Data sources for emission inventories include pollution reports of environmental agencies and industrial surveys of pollution and solid waste. An example of part of an inventory is table 7, which organizes qualitative information by settlement area.

Table 7. Gaseous emissions in selected areas, Pakistan

Area	Number of industries covered in survey	Range of heights of emission points (metres)	Harmful emission
Karachi	11	6 to 50	HC H_2S Lead particulate matter Ammonia and solvents Dust and carbon, cement dust fall etc.
Multan	11	6 to 43	NO_2 Cl_2 CO Ammonium salts Methane
Faisalabad	10	7 to 50	SO_2 Methane SO_3 and fluorine

Source: Government of Pakistan, Federal Bureau of Statistics, Statistics Division, Environment Statistics of Pakistan 1984 (Karachi), part of table 5.1.11, p. 270.

D.2.2 Hazardous work environment and industries

142. The topics relating to indoor pollution and other environmental risks of the "working environment" are not dealt with in the present report because of unresolved conceptual problems of identifying and defining relevant parameters as well as the considerable difficulties of data collection. A list of industries with hazardous working environments could be provided as a first step in the development of an information base in this area (see A.2.2).

D.2.3 Human settlements vulnerable to natural disasters

143. The listing of human settlements by potentially hazardous areas informs planners of environmental risks associated with the further development, planning and management of human settlements in such areas. The classification of potential risk areas will be developed in a report on statistics of the natural environment (in preparation) for the identification and assessment of areas that are particularly vulnerable to natural hazards.

VARIABLES (Unit of measurement)	CLASSIFICATIONS
a. Human settlements (listed by name)	Potential risk areas

D.3 Background conditions

144. "Background" data for human settlements statistics provide information from other statistical systems. Such data may help in assessing relationships between human settlements and other related fields of policy or research, provide a starting point for the assessment of a broader concept of human settlements or may simply illustrate some features of the general social, economic or environmental settings within which human settlements activities take place. Because of the wide range of possible uses of these data, the following selection of topics and variables is an illustration, rather than a definite proposal, of "background statistics".

145. The background variables thus refer to four statistical topics, whose variables are typically found in general national and international statistical publications. The data provide basic information concerning land-use patterns (D.3.1), the demographic and social situation of human settlements (D.3.2), economic activity in settlements (D.3.3) and weather and climate conditions (D.3.4). To the extent possible, such data should be presented for major cities and settlements by population size, as suggested for most human settlements statistics (see paras. 27 and 28 above).

D.3.1 Land use

146. Land use statistics complement variable A.1.5.a, Settlement land area, which shows land use in human settlements. Land use will be cross-referenced to a report on statistics of the natural environment (in preparation), where data on land use outside of human settlements, in addition to the built-up and related land of settlements, are presented.

VARIABLES (Unit of measurement)	CLASSIFICATIONS
a. Land use area	(Will be presented in a report on statistics of the natural environment - in preparation)

D.3.2. Demographic and social conditions

147. The socio-demographic data presented below constitute basic demographic indicators of populations and their general socio-economic and health status. As throughout the report, they are to be classified by major cities and selected important settlements as well as by population size classes of human settlements.

VARIABLES (Unit of measurement)	CLASSIFICATIONS
a. Settlement population (number)	
b. Settlement population density (number per square kilometre)	
c. Infant mortality rate (rate)	
d. Life expectancy at birth (years)	
e. Total fertility rate (rate)	
f. Age distribution (number)	Age group

148. Data sources for these variables are population and housing censuses and population, mortality and fertility surveys. Estimates and projections of city populations are often routinely made in central statistical offices and by population divisions of municipal, regional and national administrations.

D.3.3 Economic situation

149. Statistics of the economically active population (variable (a)) describe industrial and agricultural activities in a country and assess the numbers of persons involved in a particular work activity. The unemployment rate (b) indicates the extent to which the labour force participates in or is absorbed by national production activities. However, this rate can be misleading if it does not take into account "informal" activities that may be a significant source of personal and national income (see para. 44 above). An inventory of industrial establishments (variable (c)) describes the type and location of industrial complexes possibly requiring monitoring and evaluation for various types of environmental impacts. Variable (d) measures capital formation in the areas of building and infrastructure, which in many countries represents the major stimulus for economic growth and development. Variable (e) may be used for analyses of income distribution, poverty in rural and urban areas and consumption patterns, especially regarding the share of housing expenditures in total household spending.

VARIABLES (Unit of measurement)	CLASSIFICATIONS
a. Economically active population (number)	Economic activity
b. Unemployment rate (per cent)	
c. Industrial establishments (number)	Economic activity
d. Gross fixed capital formation in construction (monetary unit)	Type
e. Household income and expenditure (monetary unit)	Source of income Category of expenditure

150. Data sources for these background variables include labour force surveys in the case of economic activity and unemployment, industrial surveys and censuses for assessing the number and type of industrial establishments in cities or regions and household surveys for measuring income, consumption and expenditure of households.

D.3.4 Weather/climate conditions

151. The general climatic situation will be described in the report on statistics of the natural environment (in preparation) as an aspect of the natural environment. As indicated above (B.2.3), microclimatic conditions are of relevance in the assessment of ecological impacts in human settlements - a topic which is not, however, further developed in this report (see B.2.2). Climatic data on larger regions are less difficult to compile and can provide a first indication of the "environmental quality" of settlements situated in these regions.

Notes

1/ United Nations publication, Sales No. E.82.XVII.4.

2/ United Nations publication, Sales No. E.83.XVII.12.

3/ United Nations publication, Sales No. E.84.XVII.12.

4/ Official Records of the Economic and Social Council 1985, Supplement No. 6 (E/1985/26), para. 86 (d).

5/ The following description of FDES is based on A Framework for the Development of Environment Statistics (United Nations publication, Sales No. E.84.XVII.12), which should be consulted for further details and references.

6/ Survey of Environment Statistics: Frameworks, Approaches and Statistical Publications (United Nations publication, Sales No. E.82.XVII.4).

Notes (continued)

7/ Additional technical reports in this series will be prepared, resources permitting, on other important issues in the development of national environment statistics programmes. For example, these reports could deal with environmental issues that cut across the FDES structure such as energy, industry and environment, pollution, or particular ecological systems.

8/ Report of the United Nations Conference on the Human Environment, Stockholm, 5-16 June 1972 (United Nations publication, Sales No. E.73.II.A.14).

9/ Report of Habitat: United Nations Conference on Human Settlements, Vancouver, 31 May-11 June 1976 (United Nations publication, Sales No. E.76.IV.7), p. 37.

10/ United Nations Centre for Human Settlements (Habitat), Global Report on Human Settlements Oxford and others, (Oxford University Press, 1987), p. 1. See also World Commission on Environment and Development, Our Common Future, (Oxford and New York, Oxford University Press, 1987) p. 243.

11/ Report of Habitat ..., pp. 4 and 37.

12/ Adopted by the General Assembly at its forty-second session (General Assembly resolution 42/186).

13/ Our Common Future ..., chap. 9.

14/ United Nations Educational, Scientific and Cultural Organization, Programme on Man and the Biosphere (MAB): International workshop on ecological problems of human settlements in arid lands, MAB Report Series, No. 54 (1981), p. 3.

15/ Principles and Recommendations for Population and Housing Censuses (United Nations publication, Sales No. E.80.XVII.8), p. 68.

16/ United Nations publication, Sales No. E/F.84.XVIII.5.

17/ Principles and Recommendations for Population and Housing Censuses ..., p. 68.

18/ Global Report on Human Settlements ..., p. 14; see also para. 44 of the present publication.

19/ Ibid., chap. 2.

20/ Principles and Recommendations for Population and Housing Censuses ....

21/ Global Report on Human Settlements ..., p. 16.

22/ International Recommendations for Construction Statistics, Statistical Papers, Series M, No. 47 (United Nations publication, Sales No. E.68.XVII.11).

23/ Economic Commission for Europe, Conference of European Statisticians, "Draft ECE Standard International Classification of Solid Wastes" (CES/548/Add.5), p. 7. See para. 140, D.2.1, for a tentative list of hazardous wastes.

24/ For example, the hydrogen peroxide-barium perchlorate or Thorin method, or the photometric method using sodium salicylate, see Economic Commission for Europe, Conference of European Statisticians "Draft ECE Standard International Classification of Ambient Air Pollution" (CES/548/Add.5), p. 8.

25/ Global Report on Human Settlements ..., p. 89.

26/ Ibid.

27/ $\triangle$ (delta) = $\frac{1}{K} \cdot \frac{P}{h_s}$

where:

P = population
h_s = average household size (number of persons per household)
K = member of households occupying a single delta.

The number of households occupying a single delta varies depending upon the socio-cultural and economic structure of the region. If it is assumed that each household requires separate accommodation, then K = 1. If households share the same delta with other households, then K is greater than 1 (World Housing Survey 1974, United Nations publication, Sales No. E.75.IV.8, p. 41).

28/ Report of Habitat ..., p. 3.

29/ Efforts to consider human settlements as ecological systems are still controversial and have not yet been applied generally in human settlements planning and policies. See, for example, United Nations Educational, Scientific and Cultural Organization, Programme on Man and the Biosphere (MAB), MAB Report Series, No. 53 and 54 (1981).

30/ Economic Commission for Europe, Conference of European Statisticians, "Statistics of Air Pollution" (CES/549), p. 6. The monitoring of ambient concentrations of air pollution is also a focus of international concern, especially through the Global Environmental Monitoring System of UNEP in co-operation with the World Health Organization (WHO): Air Monitoring Programme Design for Urban and Industrial Areas, WHO publication No. 33 (Geneva, 1980); Analyzing and Interpreting Air Monitoring Data, WHO publication No. 51 (Geneva, 1980); Estimating Human Exposure to Air Pollutants, WHO publication No. 69 (Geneva, 1982).

31/ WHO, Estimating Human Exposure ..., p. 8.

32/ See annex. The full classification is shown in the context of an emission inventory in para. 139 (D.2.1) of the present publication.

33/ Statistics of Air Quality: Some Methods (United Nations publication, Sales No. E.84.II.E.29), pp. 19-20.

34/ ECE, Conference of European Statisticians, "Draft ECE Standard International Classification of Ambient Air Pollution" ..., p. 5.

35/ An overview of the more common methods of presentation and analysis of air pollution is given in WHO, Analyzing and Interpreting Air Monitoring Data ....

36/ A brief review of PSI is given in Statistics of Air Quality ....

37/ WHO, Estimating Human Exposure ..., pp. 7, 8.

38/ Report of Habitat ..., p. 2.

39/ Of course such indicators cannot "objectively" assess the actual state and quality of the environment in human settlements. For a discussion of measuring the quality of life by objective socio-economic and subjective quality of life indicators see, for example, United Nations Educational, Scientific and Cultural Organization, Quality of life: Problems of assessment and measurement, Socio-economic Studies No. 5 (Paris, 1983).

40/ These programmes seem to have received renewed attention in a shift of human settlements strategies from low-cost housing programmes and marginal settlements up-grading towards "enabling settlements strategies" that "fuse settlement-wide action with local initiatives". Global Report on Human Settlements ..., chap. XIV.

41/ Statistics of Air Quality ....

42/ Report of the Secretary-General on environment statistics, "Draft guidelines on materials/energy balances" (E/CN.3/492).

43/ Official Records of the Economic and Social Council, Sixty-second Session, Supplement No. 2, para. 112. As an alternative, "resource accounts" for selected natural resources have been proposed more recently (see report on statistics of the natural environment - in preparation).

44/ Principles and Recommendations for Population and Housing Censuses ....

45/ Ibid., p. 2.

46/ ECE Conference of European Statisticians, "Draft ECE Standard International Classification of Ambient Air Pollution" ....

47/ ECE Conference of European Statisticians, "Draft ECE Standard International Classification of Solid Wastes" ..., p. 7.

Annex

LIST OF VARIABLES - HUMAN SETTLEMENTS STATISTICS

FRAMEWORK FOR THE DEVELOPMENT OF ENVIRONMENT STATISTICS - HUMAN SETTLEMENTS

Social and economic activities, natural events A	Environmental impacts of activities/events B	Responses to environmental impacts C	Stocks, inventories and background conditions D
1. Settlements growth and change 1.1 Population growth and change 1.2 Construction of shelter and infrastructure 1.3 Utilities (energy and water supply) 1.4 Transport 1.5 Land use in human settlements 2. Other activities 2.1 Emission and waste discharge 2.2 Hazardous activities at work-place [not developed] 3. Natural events	1. Conditions of shelter, infrastructure and services 1.1 Housing 1.2 Access to infrastructure and services 1.3 Human settlements sprawl and dispersion 2. Conditions of life-supporting resources 2.1 Ambient concentration of pollutants and wastes 2.2 Biological and ecological impacts [not developed] 2.3 Microclimates [not developed] 3. Health and welfare conditions in human settlements 3.1 Exposure and health effects 3.2 Settlements-related damage and accidents 3.3 Perception of the quality of life in human settlements	1. Human settlements policies and programmes 2. Pollution monitoring and control 2.1 Environmental standards 2.2 Monitoring 2.3 Treatment, disposal and reuse of discharges 2.4 Expenditure for pollution control 3. Prevention and hazard mitigation of natural disaster	1. Stocks of shelter and infrastructure 1.1 Housing stock 1.2 Non-residential buildings and other physical infrastructure 2. Environmental inventories 2.1 Emissions 2.2 Hazardous work environment and industries [not developed] 2.3 Human settlements vulnerable to natural disasters 3. Background conditions 3.1 Land use 3.2 Demographic and social conditions 3.3 Economic situation 3.4 Weather/climate conditions

Statistical topic	Variables	Unit of measurement	Definitions/explanations	Classifications	Likely data source
A.1 SETTLEMENTS GROWTH AND CHANGE					
A.1.1 Population growth and change	a. Average rate of change in population size	(Per cent)	Average rate of change = average annual rate of growth (exponential rate in percentage) in the preceding five-year period a/		Population census, population survey, projections and estimates
	b. Net migration rate	(Per thousand)	Net migration rate = the difference between gross immigration and gross emigration per 1,000 of the mid-year population a/		Population census, population survey, projections and estimates, civil registration
A.1.2 Construction of shelter and infra-structure	a. Housing units	Number	Housing unit = separate and independent place of abode intended for habitation by one household, or one not intended for habitation but occupied as living quarters by a household b/ Conventional dwelling = room or suite of rooms and its accessories in a permanent building or structurally separated part thereof, which by the way it has been built, rebuilt or converted, is intended for habitation by one household and is not used wholly for other purposes (such as houses, flats, suites or rooms, apartments and the like) b/ Mobile housing unit = any type of living accommodation that can be transported (such as a tent) or that is a moving unit (such as a boat, barge, railroad car, trailer etc.) occupied as a living quarter b/ Marginal housing unit = unit characterized by the fact that it is either makeshift shelter constructed of waste materials and generally considered unfit for habitation (squatter's huts, for example) or a place that is not intended for human habitation although in use for that purpose b/ Informal sector: see text	Structural type of housing units: -conventional dwellings -mobile housing units -marginal housing units (improvised housing unit/ housing units in permanent buildings not intended for human habitation/other premises not intended for human habitation) b/ Type of building activity: -new construction -restoration, extension, conversion c/ Type of investor: -public sector (State and local Government/ other public bodies) -private sector (excluding informal sector) (private persons/co-operatives/ other private bodies) -informal sector	Housing census, housing surveys, construction records (building permits), special surveys (informal sector)
	b. Collective living quarters other than housing units	Number	Collective living quarter = structurally separate and independent place of abode intended for habitation by large groups of individuals or several households b/	Category of collective living quarter: -hotels, rooming houses or other lodging houses -institutions -camps -other living quarters b/	Housing census, housing surveys, construction records (building permits)

Statistical topic	Variables	Unit of measurement	Definitions/explanations	Classifications	Likely data source
A.1 SETTLEMENTS GROWTH AND CHANGE (continued)					
A.1.2 Construction of shelter and infrastructure (continued)				Type of building activity: -new construction -restoration, extension, conversion c/	
	c. Residential and non-residential buildings	Number	Non-residential = major part of building (more than half of its floor area) is for uses other than dwelling b/	Type of building: -residential -non-residential (industrial/commercial/ educational/health/other) b/	Censuses, construction surveys, construction records (building permits)
	d. Decrease in housing stock	Number	Decrease in housing stock = conversion, demolition, destruction by natural disasters and other activities (e.g. military action)	Category of living quarters: -housing units (conventional dwellings/ mobile housing units/ marginal housing units) -other living quarters Reason for decrease in stock: -conversion -demolition -destruction by fire, flood or other activities	Housing census, municipal records, construction records (building permits)
	e. Civil engineering construction projects	Number of projects, kilometres of roads and railroads, and other units of project size	Civil engineering construction = construction not classified under building construction, e.g. railways, roads, bridges, highways, airports, water and sewerage projects, dams and irrigation projects etc. d/ Unit of project size = unit reflecting capacity or amount of potential infrastructural services	Type of physical infrastructure: -transportation infrastructure by mode (land/air/water) -energy infrastructure (water power projects, pipelines, electricity etc.) -communication (telephone, telegraph etc.) -sanitation and water-related projects (sewerage, water supply, sanitation projects, dams, reservoirs)	Construction surveys, construction records (building permits)
A.1.3 Utilities (energy and water supply)	a. Energy supply		(Will be presented in a report on statistics of the natural environment - in preparation)		
	b. Water supply		(Will be presented in a report on statistics of the natural environment - in preparation)		

Statistical topic	Variables	Unit of measurement	Definitions/explanations	Classifications	Likely data source
A.1 SETTLEMENTS GROWTH AND CHANGE (continued)					
A.1.4 Transport	a. Road vehicles in use	Number	Vehicle definitions and classifications see e/	Type of land or road vehicle: -motor vehicles (motorcycles and mopeds/ commercial passenger cars/ private passenger cars/buses, trolley buses and tramcars/ goods vehicles/other) -non-motor vehicles (animal drawn/ pedal driven/others)	Motor vehicle registration records
	b. Vessels arriving and departing ports	Number, tonnage	Tonnage = total net registered tonnage of vessels arriving and departing	Port cities	Port records, transport surveys
	c. Air traffic	Number	Arrivals and departures of aircraft flights	Major city (name of airport)	Airport records, transport surveys
	d. Passenger transport	Number of passengers, passenger kilometres		Mode of transport: -air -marine water -inland water (by watercourse) -rail -road Major city	
	e. Freight transport	Tons of freight, ton kilometres		Mode of transport: -air -marine water -inland water (by watercourse) -rail -pipeline -road	
A.1.5 Land use in human settlements	a. Settlement land area	Square kilometres	Settlement land use = the occupation of houses, roads, mines and quarries and other facilities, including their auxiliary spaces deliberately installed for the pursuit of human activities f/ Built-up area = all land occupied by residential and non-residential buildings, together with their inner courts, gardens, yards	Type of land use of built-up and related land: -residential land (with mainly one- or two-storey buildings/ with mainly three- or more-storey buildings) -industrial land -commercial land, land used for public services and facilities (excluding transport and communication facilities) -land under transport and communication facilities	Municipal and administrative records, land surveys, aerial surveys

Statistical topic	Variables	Unit of measurement	Definitions/explanations	Classifications	Likely data source
A.1 SETTLEMENTS GROWTH AND CHANGE (continued)					
A.1.5 Land use in human settlements (continued)	a. Settlement land area (continued)			(motorways and other roads/ railways/airports and related facilities/harbour and related storage facilities/ high voltage transmission lines and undersurface pipelines/ other transport and communications facilities) -recreational land -related open land inside localities, excluding recreational land (land for disposal of waste/other open land) f/ -Major city	
	b. Area of marginal settlements		(see text para. 55)		
A.2 OTHER ACTIVITIES					
A.2.1 Emission and waste discharge	a. Air pollution emissions	Tons	WHO, WMO and ISO standards being developed g/	Type of pollutant: -sulfur dioxide (stationary sources/mobile sources) -nitrogen dioxide -particulate matter -lead -gaseous radioactive discharges g/ Type of activity: -domestic heating and cooking -industrial boilers, power plants -manufacturing (ISIC division) h/ -transportation -other	Ad hoc surveys of industrial establishments, readings from emission control facilities, activity estimates
	b. Noise emissions		See B.2.1.d and text (para. 58)		
	c. Waste water and liquid discharges		(see report on statistics of the natural environment - in preparation)		

Statistical topic	Variables	Unit of measurement	Definitions/explanations	Classifications	Likely data source
A.2 OTHER ACTIVITIES (continued)					
A.2.1 Emission and waste discharge (continued)	d. Solid waste collected	Cubic metres, tons	Solid wastes = solids not treated in waste-water treatment plants nor discharged directly into ambient waters or ambient air i/ Sludge generated by treatment plants: also will be presented in a report on statistics of the natural environment - in preparation	Type of solid waste: -agricultural and forestry wastes -industrial wastes -demolition waste -mining and quarrying wastes -sludge -car wrecks, used tyres and shredding residues -special hospital waste -radioactive wastes -household and similar wastes -other solid wastes i/	Ad hoc surveys, municipal records
A.2.2 Hazardous activities at work-place			(Not developed, see text)		
A.3 NATURAL EVENTS					
	a. Occurrence	Frequency and magnitude	(Will be presented in a report on statistics of the natural environment - in preparation)	Type of natural event: -geological hazards (earthquakes/tsunamis/ landslides/other) -weather and climate hazards (severe storms/floods/ droughts/avalanches/other) City affected	Seismic and other geological records, meteorological reports

B. ENVIRONMENTAL IMPACTS OF ACTIVITIES/EVENTS

Statistical topic		Variables	Unit of measurement	Definitions/explanations	Classifications	Likely data source
B.1	CONDITIONS OF SHELTER, INFRASTRUCTURE AND SERVICES					
B.1.1	Housing	a. Occupants of living quarters	Number	Living quarter = housing unit (see A.1.2.a) or collective living quarter (see A.1.2.b)	Structural type of living quarter: -housing units (see A.1.2.a for further breakdown) -collective living quarters: (see A.1.2.b for further breakdown)	Population and housing census, housing survey, household survey
		b. Homeless persons	Number	Homeless persons = persons without shelter that would fall within the scope of living quarters (see B.1.1.a) e/		Population and housing census, housing survey, household survey
		c. Rate of occupancy	Number	Rate of occupancy = average number of persons per room	(see A.1.2.a,b)	Population and housing census, housing survey, household survey
B.1.2	Access to infra-structure and services	a. Settlements supplied with electricity	Number	Settlements supplied with electricity = more than 50 per cent of housing units have access to an electrical system		Municipal records
		b. Households supplied with water	Number	(Will be presented in a report on statistics of the natural environment - in preparation)	Distance to water supply: -inside the living quarters -outside the living quarters (within 100 metres) -outside the living quarters (more than 100 metres away) b/ Water quality: -potable -non-potable	Population and housing census, household survey, municipal records
		c. Household with access to sanitation system	Number		Type of sanitation system: -community sewerage system (piped system/open ditch) -individual system (septic tank/cesspool/pit) -other system (e.g. draining directly into open waters) b/	Population and housing census, household survey, municipal records
		d. Households supplied with electricity	Number	(Will be presented in a report on statistics of the natural environment - in preparation)		Population and housing census, housing survey, municipal records

Statistical topic	Variables	Unit of measurement	Definitions/explanations	Classifications	Likely data source
B.1 CONDITIONS OF SHELTER, INFRASTRUCTURE AND SERVICES (continued)					
B.1.2 Access to infra-structure and services (continued)	e. Households supplied with garbage and refuse disposal	Number			Population and housing census, household survey, municipal records
	f. Average distance from home to nearest public trans-portation system	Metre			Household survey, transportation survey
	g. Average time spent travelling from home to work-place	Minutes		Type of transport: -public road transport -public rail transport -private motorized transport -non-motor vehicles -other	Household survey, transportation survey
B.1.3 Human settlements sprawl and dispersion	a. Primacy rate	(Per cent)	Primacy rate = ratio of the largest city's population over the sum of the populations of the four largest cities		Population and housing census
	b. Average distance from settlements to nearest primary city	Kilometres	Primary city = largest city by population size in the region		Geographical mapping
	c. Changes in built-up and related land area	Square kilometres	Built-up and related land: see A.1.5.a		Municipal records, aerial surveys, remote sensing
B.2 CONDITIONS OF LIFE-SUPPORTING RESOURCES					
B.2.1 Ambient concentration of pollutants and waste	a. Ambient concentration of air pollutants	Micrograms per cubic metre (annual 24-hour arithmetic mean)	Hourly, daily and monthly averages need to be calculated for the assessment of diurnal and seasonal fluctuations (see text) Background concentration of air pollutants (will be presented in a report on statistics of the natural environment - in preparation)	Type of pollutant: -sulfur dioxide -nitrogen dioxide -ozone (surface/total atmospheric) -hydrocarbons (aliphatic/non-methane) -carbon monoxide -lead -particulate suspended matter g/ Location of monitoring stations (settlement name)	Air monitoring networks

Statistical topic	Variables	Unit of measurement	Definitions/explanations	Classifications	Likely data source
B.2. CONDITIONS OF LIFE SUPPORTING RESOURCES (continued)					
B.2.1 Ambient concentration of pollutants and waste (continued)	b. Air monitoring stations	Number		Classes of ambient concentrations (including national standards) Type of pollutant (see B.2.1.a) Location of monitoring stations (settlement name) Type of area: -industrial -residential -commercial	Air monitoring networks
	c. Concentrations in acid precipitation		(Will be presented in a report on statistics of the natural environment - in preparation)		
	d. Noise monitoring stations	Number		Classes of noise levels (including national standards) Location of monitoring stations (settlement name)	Noise monitoring stations
	e. Ambient concentration of water pollutants		(Will be presented in a report on statistics of the natural environment - in preparation)		
B.2.2 Biological and ecological impacts			(Not developed - see text)		
B.2.3 Microclimates			(Not developed - see text)		
B.3 HEALTH AND WELFARE CONDITIONS IN HUMAN SETTLEMENTS					
B.3.1 Exposure and health effects	a. Population exposed to excessive noise	Number (per cent)	Execessive noise = noise levels exceeding national standards	Selected city areas: -industrial -residential, commercial -airport areas	Noise monitoring stations, population census and survey
	b. Diseases associated with housing conditions	Number per 100,000 population	Diseases associated with overcrowding, poor housing, poor ventilation	Type of disease: -tuberculosis -cerebrospinal meningitis -other respiratory and communicable diseases	Annual health reports, epidemiological surveys, estimates of incidence

Statistical topic	Variables	Unit of measurement	Definitions/explanations	Classifications	Likely data source
B.3 HEALTH AND WELFARE CONDITIONS IN HUMAN SETTLEMENTS (continued)					
	c. Diseases associated with working conditions		(see text - A.2.2)		
	d. Water-borne and water-related diseases		(Will be presented in a report on statistics of the natural environment - in preparation)		
B.3.2 Settlement-related damage and accidents	a. Shelter and infrastructure damaged or destroyed by natural disasters	Number and other physical units (see A.1.2.e), monetary unit	Monetary unit refers to cost estimates of damage	Cause of damage: -geological hazards (earthquakes, tsunamis/ landslides/other) -weather and climate hazards (severe storms/floods/ droughts/avalanches/other) -fire Type of shelter and infrastructure: -residential (see A.1.2.a,b) -non-residential (see A.1.2.c) -civil engineering projects (see A.1.2.e)	Emergency operations records, administrative records, special studies, economic reports
	b. Injury and loss of life from natural disasters	Number (rate per 100,000 population)		Cause of injury or loss of life: see B.3.2.a (cause of damage)	
	c. Injury and loss of life from road traffic accidents	Number			Transport safety information reports, police reports
	d. Injury and loss of life from industrial accidents	Number		Agency of accident: -machines -means of transport and lifting equipment -other equipment -materials, substances and radiations -working environment -other agencies not elsewhere classified j/ Type of industry h/	Industrial health surveys and reports

Statistical topic	Variables	Unit of measurement	Definitions/explanations	Classifications	Likely data source
B.3	HEALTH AND WELFARE CONDITIONS IN HUMAN SETTLEMENTS (continued)				
B.3.3 Perception of the quality of life in human settlements	a. Perception of housing unit	Number (per cent)	Ratings may be dichotomous or on appropriate scale, e.g. excellent, good, fair, poor	Rating Age group of respondent	Ad hoc quality of life survey, household survey
	b. Perception of neighbourhood conditions	Number (per cent)	Ratings - see B.3.3.a	Rating Type of environmental condition: -intensity of commercial or industrial use of the neighbourhood -traffic intensity (road, rail or plane) -noise levels -abandonment of buildings -unplanned or improvised housing in the neighbourhood -air quality -other environmental concern Age group of respondent	
	c. Perception of neighbourhood services	Number (per cent)	Ratings - see B.3.3.a	Rating Type of service: -public transportation -shopping -hospitals and health clinics -schools -police -fire protection -outdoor recreation facilities Age group of respondent	
	d. Perception of noisiness of dwelling area	Number (per cent)		Categories of noisiness of dwelling area: -silent -appropriate -noisy -very noisy Primary source of noise: -factories -transport, traffic -construction works -neighbourhood noise and amusement -sources within dwelling due to thin walls or poor insulation -other	

Statistical topic	Variables	Unit of measurement	Definitions/explanations	Classifications	Likely data source
C.1 HUMAN SETTLEMENTS POLICIES AND PROGRAMMES					
	a. Expenditure for human settlements development	Monetary unit	Financial resources allocated to and spent for the improvement of conditions in human settlements	Type of programme: -housing (low income housing/other) -rehabilitation or improvement of marginal settlements -land development -infrastructure Source of expenditure: -government -other Type of expenditure: -actual expenditure (investment/running cost) -budget allocation	National accounts, development plans
	b. Community development programmes	Number		Type of participation (in) -planning and design -implementation and management -general organization	Development plans
	c. Self-help housing units constructed	Number	Traditional technology = technology that is almost entirely of a non-monetary character, utilizing indigenous skills and locally available materials Conventional technology = established crafts, such as stone and brick masonry and carpentry work Modern technology = reinforced concrete technology, pre-stressed concrete, steel frame structure and professional managerial and supervisory skills k/	Construction technologies: -traditional -conventional -modern k/	Housing surveys, construction records, development plans, records of financial institutions
	d. Violations of building codes and regulations prosecuted	Number	Codes and regulations as locally defined	Type of violation: -structural -health -fire -public safety	Municipal and legal records
	e. Settlements area under land use regulations	Square kilometres		Type of regulation (zoning)	Municipal records
	f. Historic sites preserved	Number	Historic sites (buildings, statues and other structures of historical or major cultural interest) defined according to national criteria	Type of historic site	

Statistical topic	Variables	Unit of measurement	Definitions/explanations	Classifications	Likely data source
C.2 POLLUTION MONITORING AND CONTROL					
C.2.1 Environmental standards	a. Air pollution emission standards	Number of parts per measured unit, db/A		Type of activity (see A.2.1.a) Type of pollutant (see A.2.1.a, and B.2.1.d)	Legislative records, reports of regulatory bodies
	b. Air pollution concentration standards	Micro-grammes per cubic metre		Type of pollutant (see B.2.1.a)	
	c. Water pollution standards		(Will be presented in a report on statistics of the natural environment - in preparation)		
	d. Solid waste treatment and removal standards			Type of solid waste (see A.2.1.d)	
C.2.2 Monitoring	a. Monitoring stations	Number		Type of pollutant monitored (see B.2.1.a,d) Location of monitoring stations: -industrial -residential -commercial -recreational -unsettled area or national preserve	Air monitoring networks, administrative records and environment reports
	b. Days with health warnings	Number		Type of health warnings: -air pollution warnings -freshwater pollution -other pollution warnings	Monitoring stations, municipal reports
	c. Violations prosecuted and regulatory actions	Number		Environmental area: -water -air -land restrictions or soil contamination -noise -other Type of action: -orders issued for suspension of polluting activity -prosecutions -convictions	Administrative records of regulatory bodies and enforcement agencies

Statistical topic	Variables	Unit of measurement	Definitions/explanations	Classifications	Likely data source
C.2 POLLUTION MONITORING AND CONTROL (continued)					
C.2.3 Treatment disposal and reuse of discharges	a. Waste water treatment		(Will be presented in a report on statistics of the natural environment - in preparation)		
	b. Reuse and recycling of solid waste	Tons	Reused materials = materials separated from waste and used again without any further significant processing i/ Recycled materials = materials separated from waste and used again after processing i/	Type of waste reused: -paper and cardboard -bottles -other glass -ferrous metals -non-ferrous metals -other mineral materials -oils -solvents -textiles, leather and synthetic fibres -rubber including tyres -other plastic materials -food materials -fly-ash used in construction -other materials i/	Municipal records, trade statistics, ad hoc waste or industrial surveys
	c. Treatment and disposal of solid waste	Tons		Type of treatment and disposal: -non-hazardous waste (incineration with recovery of energy/incineration without recovery/biological/ sorting/landfill) -hazardous waste treatment including radioactive waste (physical or chemical treatment/ thermal/biological/conditioning of radioactive water) -hazardous waste disposal (landfill/geological containment/ dumping) i/	Municipal records of waste collection services, ad hoc surveys, annual surveys of industrial wastes
C.2.4 Expenditure for pollution control	a. Expenditure for pollution control	Monetary unit		Type of expenditure: -investment -running cost Area of expenditure: -water pollution control (will be presented in a report on statistics of the natural environment - in preparation) -solid waste collection, treatment and control -air pollution control -noise control Source of expenditure: -industry h/ -public administration -other	Fiscal reports, development plans, industrial censuses and surveys

Statistical topic	Variables	Unit of measurement	Definitions/explanations	Classifications	Likely data source
C.3. PREVENTION AND HAZARD MITIGATION OF NATURAL DISASTER					
	a. Expenditure for hazard prevention and mitigation	Monetary unit		Type of hazard: -geological (earthquakes/tsunamis/ landslides/other) -weather and climate (severe storms/ floods/droughts/ avalanches/other) Source of expenditure: -government -other	Fiscal records, development plans

Statistical topic	Variables	Unit of measurement	Definitions/explanations	Classifications	Likely data source
D.1 STOCKS OF SHELTER AND INFRASTRUCTURE					
D.1.1 Housing stock	a. Living quarters	Number	Living quarters see (see B.1.1.a) Tenure = the arrangements under which households occupy their living quarters b/	Category of living quarters (see B.1.1.a) Type of tenure: -owned by member of household -rented -subrented -other Age class of living quarters	Housing census, housing survey
	b. Housing units with toilet facilities	Number	Housing unit (see A.1.2.a) Toilet = installation for the disposal of human excreta Flush toilet = toilet connected with piped water b/	Category of housing units (see A.1.2.a) Type of toilet: -flush toilet -non-flush toilet -without toilet installation	
	c. Housing units with water supply system	Number	Piped water = water provided within housing units by pipe from community-wide systems or from individual installations such as pressure tanks and pumps e/	Category of housing units (see A.1.2.a) Type of water supply system: -piped water in the housing unit -piped water outside the housing unit (within 100 metres) -without piped water b/ Quality of water provided: -potable -non-potable (WHO criteria)	
	D. Housing units with facilities	Number		Category of housing unit (see A.1.2.a) Type of facility: -electric lighting -kitchen or kitchenette -fixed bath or shower e/ -equipment used for cooking and refrigeration (gas stove/ electric stove/hot plate/ open fire/other cooking facilities/refrigeration) -fuel used for cooking (electricity/gas/wood or charcoal/liquid fuel/other)	

Statistical topic		Variables	Unit of measurement	Definitions/explanations	Classifications	Likely data source
D.1	INVENTORY OF SHELTER AND INFRASTRUCTURE (continued)					
D.1.2	Non-residential buildings and other physical infra-structure	a. Non-residential buildings	Number	Non-residential building (see A.1.2.c)	Type of non-residential building (see A.1.2.c)	Municipal records, housing census
		b. Civil engineering structures	Number	Civil engineering construction (see A.1.2.e)	Type of physical infrastructure (see A.1.2.e)	Municipal records, construction surveys
D.2	ENVIRONMENTAL INVENTORIES					
D.2.1	Emissions	a. Air pollutants	List of pollutants	An emission inventory lists pollutants with reference to (industrial and non-industrial) sources of pollution; list of pollutants - see text	Type of activity (see A.2.1.a)	Records of environmental agencies, industrial surveys
		b. Water pollutants		(Will be presented in a report on statistics of the natural environment - in preparation)		
		c. Solid wastes	List of solid wastes	List of solid wastes(see A.2.1.d) Categories of hazardous wastes (see text)	Source of solid waste	
D.2.2	Hazardous work environment and industries			(not developed, see text)		
D.2.3	Human settlements vulnerable to natural disasters	a. Human settlements	List of human settlements		Potential risk areas (Will be presented in a report on statistics of the natural environment - in preparation)	
D.3	BACKGROUND CONDITIONS					
D.3.1	Land use	a. Land use area		(Will be presented in a report on the statistics of the natural environment - in preparation)		
D.3.2	Demographic and social conditions	a. Settlement population	Number			Population census and survey

Statistical topic	Variables	Unit of measurement	Definitions/explanations	Classifications	Likely data source
D.3 BACKGROUND CONDITIONS (continued)					
	b. Settlement population density	Number per square kilometre			Population census and survey
	c. Infant mortality rate	(rate)			Household survey, population survey, mortality survey
	d. Life expectancy at birth	Years			Population and mortality survey
	e. Total fertility rate	(rate)			Population and fertility survey, census
	f. Age distribution	Number		Age group	Population census, household survey
D.3.3 Economic situation	a. Economically active population	Number		Economic activity h/	Labour force survey
	b. Unemployment rate	(Per cent)			Labour force survey
	c. Industrial establishments	Number		Economic activity h/	Industrial surveys, censuses
	d. Gross fixed capital formation in construction	Monetary unit		Type: -residential buildings -non-residential buildings -other construction, except land improvement -land improvement	National accounts
	e. Household income and expenditure	Monetary unit		Source of income 1/ Category of expenditure 1/	Household surveys, national accounts
D.3.4 Weather/ climate conditions			(Will be presented in a report on statistics of the natural environment - in preparation)		

(Footnotes on following page)

Notes

a/ World Population Prospects, Estimates and Projections as Assessed in 1982 (United Nations publication, Sales No. E.83.XIII.5).

b/ Principles and Recommendations for Population and Housing Censuses (United Nations publication, Sales No. E.80.XVII.8).

c/ Annual Bulletin of Housing and Building Statistics for Europe, vol. XXX, 1986 (United Nations publication, Sales No. E/F/R.87.II.E.8).

d/ International Recommendations for Construction Statistics, (United Nations publication, Sales No. E.68.XVII.11).

e/ Compendium of Human Settlements Statistics 1983 (United Nations publication, Sales No. E/F.84.XVII.5).

f/ Economic Commission for Europe, Conference of European Statisticians, "Draft ECE Standard International Classification of Land Use" (CES/548/Add.1), 1985.

g/ Economic Commission for Europe, Conference of European Statisticians, "Draft ECE Standard International Classification of Ambient Air Pollution" (CES/548/Add.3), 1985.

h/ International Standard Industrial Classification of All Economic Activities (United Nations publication, Sales No. E.68.XVII.8).

i/ Economic Commission for Europe, Conference of European Statisticians, "Draft ECE Standard International Classification of Solid Wastes" (CES/548/Add.5).

j/ World Health Organization, International Classification of Diseases, 1975 revision, vol. 1.

k/ World Housing Survey 1974 (United Nations publication, Sales No. E.75.IV.8).

l/ International Labour Office, Household Income and Expenditure Statistics, No. 3, 1968-1976.

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