ISO 37120

Sustainable development of communities

Indicators for city services and quality of life

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Executive summary

— ISO 37120 establishes definitions and methodologies for a set of city indicators to steer and measure delivery of city services and quality of life. As part of a new series of International Standards being developed for a holistic and integrated approach to sustainable development and resilience, this set of standardized indicators provides a uniform approach to what is measured, and how that measurement is to be undertaken.

— The requirements contained in this International Standard are applicable to any city, municipality or local government that undertakes to measure its performance in a comparable and verifiable manner, irrespective of size and location.

— The indicators can be used to track and monitor a city's progress on city service performance and quality of life and assist cities in setting targets and monitoring achievements. In order to achieve sustainable development, the whole city system needs to be taken into consideration. Planning for future needs must take into consideration current use and efficiency of resources in order to better plan for tomorrow.

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 268, *Sustainable development in communities.*

Introduction

Cities need indicators to measure their performance. Existing indicators are often not standardized, consistent, or comparable over time or across cities.

As part of a new series of International Standards being developed for a holistic and integrated approach to sustainable development and resilience, this set of standardized indicators provides a uniform approach to what is measured, and how that measurement is to be undertaken. As a list, it does not provide a value judgement, or threshold or a target numerical value for the indicators.

Conformance with this standard does not confer a status in this regard. A city which conforms to this standard in regards to measurement of indicators for city services and quality of life may only claim compliance to that effect.

These indicators can be used to track and monitor progress on city performance. In order to achieve sustainable development, the whole city system needs to be taken into consideration. Planning for future needs must take into consideration current use and efficiency of resources in order to better plan for tomorrow.

The indicators and associated test methods in this International Standard have been developed in order to help cities:

a) measure performance management of city services and quality of life over time;

b) learn from one another by allowing comparison across a wide range of performance measures; and,

c) share best practices.

NOTE It is acknowledged that cities may not have direct influence or control over factors governing some of these indicators, but the reporting is important for meaningful comparison and provides a general indication of service delivery and quality of life within a city.

The indicators in this International Standard have been selected to make reporting as simple and inexpensive as possible, and therefore reflect an initial platform for reporting. Further development of indicators to support sustainable development and resilience in cities is on-going in TC268.

The indicators are structured around themes. Recognizing the differences in resources and capabilities of cities worldwide, the overall set of indicators for city performance has been divided into “core” indicators (those implementing this International Standard shall follow) and “supporting” indicators, (those implementing this International Standard should follow). Both core and supporting indicators are listed in Annex A, Table A.1. In addition, profile indicators, which provide basic statistics and background information to help cities determine which cities are of interest for comparisons, are included in Annex B, Table B.1, as a reference.

In this International Standard, the following verbal forms are used:

— “shall” indicates a requirement;

— “should” indicates a recommendation;

— “may” indicates a permission;

— “can” indicates a possibility or a capability.

1 Scope

This International Standard defines and establishes methodologies for a set of indicators to steer and measure the performance of city services and quality of life. It follows the principles set out and can be used in conjunction with ISO 37101:—, *Sustainable development in communities — Management systems — General principles and requirements,* when published, and other strategic frameworks.

This International Standard is applicable to any city, municipality or local government that undertakes to measure its performance in a comparable and verifiable manner, irrespective of size and location.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 37101:—, *Sustainable development and resilience of communities — Management systems — General principles and requirements*

ISO 1996-2:—, *Acoustics Description, measurement and assessment of environmental noise — Part 2: Determination of environmental noise levels*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 37101, and the following apply.

3.1
city
urban community falling under a specific administrative boundary, commonly referred to as a city, municipality or local government

3.2
indicator
a quantitative, qualitative or descriptive measure

[SOURCE: ISO 15392:2008, 3.14]

Note 1 to entry: Indicators in this standard are divided into:

a) core indicators: indicators that are required to demonstrate performance in the delivery of city services and quality of life.

b) supporting indicators: indicators that are recommended to demonstrate performance in the delivery of city services and quality of life.

c) profile indicators: indicators that provide basic statistics and background information to help cities determine which cities are of interest for peer comparisons. Profile indicators are used as an informative reference.

3.3
full-time enrolment
enrolment in school for every full school day in a week over the entire school year

3.4
natural disaster
a natural event such as a flood, earthquake, or hurricane that causes great damage or loss of life

3.5
part-time enrolment
enrolment in school for at least every half-day in a week over the entire school year or equivalent on a weekly basis

EXAMPLE A student is counted as enrolled part-time if he/she is enrolled in school for every half-day in a week, but is not counted as enrolled if he/she is only enrolled for 0,25 of a day.

3.6
primary education
elementary school
education that is considered to be the first stage of 'basic education'

Note 1 to entry: Primary education typically covers six years of full-time schooling with the legal age of entrance normally being not younger than 5 years or older than 7 years. Primary education typically lasts until age 10 to 12. Primary education refers to children ages 5-12 years or 1st grade through 5th or 6th grade as defined by local education systems.

[SOURCE: UNESCO Institute for Statistics, UOE data collection on education systems, 10.1]

3.7
secondary education
education that is considered to be the second stage of basic education and marks the end of compulsory education where it exists

Note 1 to entry: Students usually enter between age 10 and 13 (age 12 being the most common). Secondary education usually ends 12 or 13 years after the beginning of primary education (or around age 18); however, systems can range between ending 11 to 14 years after beginning school (or around age 17 to 20). Secondary education also refers to 6^{th} grade (or 7^{th} grade) to 12^{th} grade as defined by local education systems.

3.8
tertiary education
education provided by universities and other higher education institutions following secondary education

3.9
hazardous waste
waste that is potentially harmful to human beings, property or the environment

[SOURCE: ISO 18113-1:2009, 3.22]

3.10
solid waste
non-soluble, discarded solid materials, including sewage sludge, municipal garbage, industrial wastes, agricultural refuse, demolition wastes and mining residues

3.11
vascular plants (tracheophytes)
plants that can internally transport water and food

4 City indicators

This International Standard is designed to assist cities in steering and assessing the performance management of city services and all service provisions as well as quality of life. It considers sustainability as its general principle and resilience as a guiding concept in the development of cities. All indicators shall be compiled on an annual basis.

Those implementing this International Standard shall report on all core indicators listed in Clauses 5 to 21 of this International Standard.

The core indicators described in this International Standard are considered essential for steering and assessing the performance management of city services and quality of life.

In order to promote best practice, cities should also report on the supporting indicators given in Clauses 5 to 21 of this International Standard.

The core and supporting indicators are classified into themes according to the different sectors and services provided by a city. The classification structure is used solely to denote the services and area of application of each type of indicator when reported on by a city. This classification has no hierarchical significance and is organized alphabetically according to themes.

Indicators under each theme, where possible, were selected and paired on the basis of input and outcome indicators for further contextual analysis.

When interpreting the results of a particular service area, it is important to review the results of multiple types of indicators across themes; to focus on a single indicator can lead to a distorted or incomplete conclusion. Elements of aspiration must also be taken into consideration in the analysis.

Users may also consider the following aspects which shall be clearly stated in the report and justified: indicators can be aggregated to larger administrative areas (ex. region, metropolitan areas etc.); since some indicators are indirectly linked to sustainability, there is a need to consider the resource efficiency of a

city; indicators can be grouped together for analysis when taking into consideration holistic characteristics of a city; and, this set of indicators may be complemented by other indicator sets in order to have a more comprehensive holistic approach to analysis on sustainability.

Furthermore, it is also important to acknowledge potential antagonistic effects of the outcome of particular indicators, either positive or negative, when analysing results. For example, an increase in air connectivity and the number of automobiles per capita will potentially result in increased levels of PM10 and greenhouse gas emissions.

For data interpretation purposes cities shall take into consideration contextual analysis when interpreting results. The local institutional environment may affect the capacity to apply indicators. In some cases, services may be delivered by the private sector or the community itself.

Table B.1 lists a series of profile indicators for reference purposes.

5 Economy

5.1 City's unemployment rate (core indicator)

5.1.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE The unemployment rate is considered one of the single, most informative labour market indicators reflecting the general performance of the labour market and the health of the economy as a whole. It is used to measure a city's unutilized labour supply and track business cycles. When economic growth is strong, unemployment rates tend to be low and when the economy is stagnating or in recession, unemployment rates tend to be higher.

5.1.2 Core indicator requirements

A city's unemployment rate shall be calculated as the number of working-age city residents who during the survey reference period were not in paid employment or self-employment, but available for work, and seeking work (numerator) divided by the total labour force (denominator). The result shall be multiplied by 100 and expressed as a percentage.

Unemployment shall refer to individuals without work, actively seeking work in a recent past period (past four weeks), and currently available for work. Persons who did not look for work but have a future labour market stake (arrangements for a future job start) are counted as unemployed (International Labour Organization). Discouraged workers or hidden unemployed shall refer to persons who are not actively seeking work because they believe the prospects of finding it are extremely poor or they have restricted labour mobility, face discrimination, and/or structural, social, and cultural barriers – are not counted as

unemployed or as part of the labour force. Not actively seeking work shall refer to people who have not taken active steps to seek work (i.e. job searches, interviews, informational meetings etc.) during a specified recent period (usually the past four weeks).

Labour Force shall refer to the sum of the total persons employed and unemployed who are legally eligible to work.

5.2 Assessed value of commercial and industrial properties as a percentage of total assessed value of all properties (core indicator)

5.2.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE Assessed value of commercial and industrial properties as a percentage of total assessed value of all properties provides an understanding of the mix of assessed values of properties as well as the stability of the assessed base. A downward trend in the proportion of commercial and industrial assessed values could indicate an eroding economic base. Over reliance on residential assessed values can impact affordability.

5.2.2 Core indicator requirements

The assessed value of commercial and industrial properties as a percentage of total assessed value of all properties shall be expressed as the total assessed value of commercial and industrial properties (numerator) divided by the total assessed value of all properties (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

Commercial and industrial properties shall refer to those which have been designated by the city for commercial and industrial use.

NOTE Property assessment methods may vary from one jurisdiction or country to another, including the market-oriented method, the profit-oriented method and the cost-oriented method.

5.3 Percentage of city population living in poverty (core indicator)

5.3.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE The percentage of the city's population living in poverty is an indicator of social equity and reflects levels of economic and social marginality and/or inclusiveness in a city. Eradication of poverty is an essential component of the Millennium Development Goals.[22]

5.3.2 Core indicator requirements

The percentage of city population living in poverty shall be calculated as the number of people living below the poverty threshold (numerator) divided by the total current population of the city (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

The total number of persons in the city living below the poverty threshold shall first be determined by multiplying the number of city households living at or below the poverty threshold by the current average number of persons per household for that city.

NOTE The poverty threshold for each country is recorded by the World Bank, which can be viewed through its website at: www.worldbank.org (search for PovertyNet) or directly on the PovertyNet website at: www.povertynet.org[34] where, the poverty threshold for households is specified as persons unable to adequately provide themselves over a 12 month period with water, food, shelter, and other basic needs for a healthy life.

5.3.3 Data interpretation

Applying current average persons per household figure to all households can lower distinctions between household size in poor and more affluent households.

5.4 Percentage of persons in full-time employment (supporting indicator)

5.4.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE The percentage of the city population in full-time employment is an indicator of the economic health of the city and the success of city economic policy.

5.4.2 Supporting indicator requirements

The percentage of persons in full-time employment shall be calculated as the number of persons in full- time employment (numerator) divided by the total city population (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

The number of persons residing in the city in full-time employment shall include those that are self- employed and shall only include the residents that work a minimum of 35 hours a week in one job and who are of legal working age.

NOTE 1 City population has been used as the denominator for this indicator instead of workforce given that population will be known for most cities. This indicator is dependent on the government agency charged with the responsibility of collecting relevant employment and population data and the precise nature of the available data.

NOTE 2 Employment is a formal labour market concept which is often complicated in developing countries with a large informal sector of the city economy.

NOTE 3 The Social Responsibility core subjects on Human Rights and Labour Practices from ISO 26000 can be considered, and are particularly useful in regards to child labour.

NOTE 4 The International Labour Organization (ILO) Fundamental Principles and Rights at Work (FPRW) include the elimination of child labour alongside the right to freedom of association and collective bargaining, elimination of forced labour, and the elimination of discrimination in employment or occupation. These fundamental principles and rights at work are mutually interdependent. Violation of one category of rights at work often has an adverse impact on the respect and realization of the others. Vice versa, recognition, promotion and implementation of one category of rights can have a beneficial impact on the respect and realization of the others.

Over the years the international community has developed a framework of international standards which seek to protect children from child labour, in particular the two important ILO Conventions on the subject and more generally the UN Convention on the Rights of the Child.[45] Whilst some progress is being made in reducing child labour, in too many cases the rights contained in these international standards are still not fully applied in practice and enforced. Users of this standard are encouraged to keep these principles in mind.

5.5 Youth unemployment rate (supporting indicator)

5.5.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE The unemployment rate is probably the best-known and most used labour market performance indicator. Youth Unemployment Rate is key indicator for quantifying and analyzing the current labour market trends and challenges of young people. Young men and women today face increasing uncertainty in their hopes of undergoing a satisfactory transition in the labour market, and this uncertainty and disillusionment can, in turn, have damaging effects on individuals, communities, economies and society at large. Unemployed or underemployed youth are less able to contribute effectively to community and national development and have fewer opportunities to exercise their rights as citizens. They have less to spend as consumers, less to invest as savers and often have no “voice” to bring about change in their lives and communities. Widespread youth unemployment and underemployment also prevents companies and countries from innovating and developing competitive advantages based on human capital investment, thus undermining future prospects. Knowing the costs of non-action, many governments around the world do prioritize the issue of youth employment and attempt to develop pro-active policies and programmes.

5.5.2 Supporting indicator requirements

Youth unemployment rate shall be calculated as the total number of unemployed youth (numerator) divided by the youth labour force (denominator). The result shall be multiplied by 100 and expressed as a percentage.

Unemployed youth shall refer to individuals above the legal working age and under 24 years of age who are without work, actively seeking work in a recent past period (past four weeks), and currently available for work. Youth who did not look for work but have a future labour market stake (arrangements for a future job start) are counted as unemployed (International Labour Organization). Discouraged workers or hidden unemployed shall not be counted as unemployed or as part of the labour force. Not actively seeking work shall refer to people who have not taken active steps to seek work (i.e. job searches, interviews, informational meetings etc.) during a specified recent period (usually the past four weeks).

Youth labour force shall refer to all persons above the legal working age and under 24 years of age, who are either employed or unemployed over a specified reference period.

NOTE Countries vary somewhat in their operational definitions of youth, in particular, the lower age limit for young people is usually determined by the minimum age for leaving school, where this exists.

5.6 Number of businesses per 100 000 population (supporting indicator)

5.6.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE The number of businesses per 100 000 can inform a city's level of economic activity and economic performance. It provides one indication of the overall business climate in a jurisdiction, and attitudes towards entrepreneurship. Strong entrepreneurial activity is closely associated with a dynamic and growing economy. The number of businesses is also used to inform competitiveness of a city. The number of businesses reflects both the number of new businesses created and the survival of existing businesses.

5.6.2 Supporting indicator requirements

The number of businesses per 100 000 population shall be calculated as the total number of businesses in a city (numerator) divided by one 100 000th of the city's total population (denominator). The result shall be expressed as the number of businesses per 100 000 population.

Businesses shall refer to companies or enterprises. The enterprise is the smallest combination of legal unit, that is, an organizational unit producing goods or services. Business can either be categorized as simple (one operating entity) or complex (multiple operating entities).

5.7 Number of new patents per 100 000 population per year (supporting indicator)

5.7.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE The number of patents issued to resident persons or corporations of a city is an indicator of commercial and technological innovation.

5.7.2 Supporting indicator requirements

The number of new patents per 100 000 population per year shall be calculated as the total number of new patents issued to resident persons and corporations of the city (numerator) divided by one 100 000th of the city's total population (denominator). The result shall be expressed as the number of patents registered per 100 000 population.

5.7.3 Data sources

As patents are generally issued by the national government cities will be reliant on another level of government to provide this information on an annual city-by-city basis.

Data should be obtained from Government Patent Offices, who maintain records of all patents registered to persons and corporations across jurisdiction.

6 Education

6.1 Percentage of female school-aged population enrolled in schools (core indicator)

6.1.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE Education is one of the most important aspects of human development. This indicator addresses the issue of educational opportunity, by indicating how widespread formal education is in the city among school-aged population. Reporting on the differential enrolment by gender is consistent with the Millennium Development Goals,[21] Goal 3: Promote Gender Equality and Empower Women.

6.1.2 Core indicator requirements

The percentage of female school-aged population enrolled in schools shall be calculated as the number of female school- aged population enrolled at primary and secondary levels in public and private schools (numerator) divided by the

total number of female school-aged population (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

The definitions of primary and secondary school detailed in Clauses 3.5 and 3.6 shall apply.

The proportion of enrolment in public and private schools should be reported, and cities shall note if private school data are included. In many cities, private schools are a significant component of education in the city. Private schools shall be recognized as providing real, bona fide education; many ministries or departments of education have a program that recognizes such schools. Enrolment in religious schools and home schools should be included if they are recognized.

One part-time enrolment of a half-day or more shall be counted as a full-time enrolment.

If the geographies of school districts and the city are different, best judgment should be used to relate enrolment data to the city boundaries.

6.1.3 Data sources

Data on school enrolment should be obtained from local school boards, or the relevant Ministry or Department of Education. If enrolment data from these sources are not available, then data for enrolment from surveys or censuses may be used.

6.2 Percentage of students completing primary education: survival rate (core indicator)

6.2.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE Survival rate measures the holding power and internal efficiency of an education system. Survival rate to grade five of primary education is of particular interest since this is commonly considered as a pre-requisite for sustainable literacy. This indicator is often used as an assessment to Millennium Development Goals.[22]

6.2.2 Core indicator requirements

The percentage of students completing primary education or survival rate shall be calculated as the total number of students belonging to a school-cohort who complete the final grade of primary education (numerator) divided by the total number of students belonging to a school-cohort, i.e. those originally enrolled in the first grade of primary education (denominator). The result shall then be multiplied by 100 and expressed as a percentage. The survival rate of primary education shall be expressed as the percentage of a cohort of students enrolled in the first grade of primary education who reached the final grade of primary education.

Survival rates for the private education sector should be reported, if known. The user of this International Standard shall note if private school data are included.

NOTE 1 This indicator measures students belonging to a school-cohort who has reached each successive grade of primary education without failing or moving to another jurisdiction.

NOTE 2 This methodology is adapted from UNESCO Education Indicator Technical Guidelines.[4]

EXAMPLE If the city reporting year is 2012 and primary education lasts five years, report the percentage of students that entered primary education in 2006 and reached the final grade of primary education in 2011.

6.2.3 Data sources

Since the calculation of this indicator is based on student-flow rates, the reliability of the survival rate depends on the consistency of data on enrolment and repeaters (those who repeat one or more grades) in terms of coverage over time and across grades.

NOTE 1 In most cities, survival rates will only be readily available for public school systems.

NOTE 2 Data on school enrolment is usually recorded by the Ministry or Department of Education.

6.3 Percentage of students completing secondary education: survival rate (core indicator)

6.3.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE Survival rate measures the holding power and internal efficiency of an education system.

6.3.2 Core indicator requirements

The percentage of students completing secondary education or survival rate shall be calculated as the total number of students belonging to a school-cohort who complete the final grade of secondary education (numerator) divided by the total number of students belonging to a school-cohort, i.e. those originally enrolled in the first grade of secondary education (denominator). The result shall then be multiplied by 100 and expressed as a percentage. The survival rate of secondary education shall be expressed as the percentage of a cohort of students enrolled in the first grade of secondary education who reached the final grade of secondary education.

Survival rates for the private education sector should be reported, if known. The user of this International Standard shall note if private school data are included.

NOTE 1 This indicator measures students belonging to a school-cohort who has reached each successive grade of secondary education without failing or moving to another jurisdiction.

NOTE 2 This methodology is adapted from UNESCO Education Indicator Technical Guidelines.[4]

EXAMPLE If the city reporting year is 2012 and secondary education lasts seven years, report the percentage of students that entered secondary education in 2004 and reached the final grade of secondary education in 2011.

6.3.3 Data sources

Since the calculation of this indicator is based on student-flow rates, the reliability of the survival rate depends on the consistency of data on enrolment and repeaters (those who repeat one or more grades) in terms of coverage over time and across grades.

NOTE 1 In most cities, survival rates will only be readily available for public school systems.

NOTE 2 Data on school enrolment are usually recorded by the Ministry or Department of Education.

6.4 Primary education student/teacher ratio (core indicator)

6.4.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE The student/teacher ratio is an indicator of the adequacy of teacher availability and can be related to the strength and quality of an education system.

6.4.2 Core indicator requirements

The student/teacher ratio shall be expressed as the number of enrolled primary school students (numerator) divided by the number of full-time equivalent primary school classroom teachers (denominator). The result shall be expressed as the number of students per teacher.

Private educational facilities shall not be included in the student/teacher ratio.

One part-time student enrolment shall be counted as one full-time enrolment; in other words a student who attends school for half a day should be counted as a full-time enrolment. If a city reports full-time equivalent (FTE) enrolment (where two half day students equal one full student enrolment), this shall be noted.

The number of classroom teachers and other instructional staff (e.g. teachers' aides, guidance counsellors), shall not include administrators or other non-teaching staff. Kindergarten or pre-school teachers and staff shall not be included.

The number of teachers shall be counted in fifth time increments, for example, a teacher working one day per week should be counted as 0,2 teachers, and a teacher working three days per week should be counted as 0,6 teachers.

6.4.3 Data sources

The number of full-time equivalent primary school classroom teachers and the number of enrolled primary school students should be collected from the local public school system or Ministry of Education.

6.4.4 Data interpretation

The student/teacher ratio reflects teacher workload and the availability of teachers' services to their students. The lower the student/teacher ratio, the higher the availability of teacher services to students. The student/teacher ratio has implications not only for the cost of education, but also for the quality. Higher educational attainment is correlated with a lower student/teacher ratio.

6.5 Percentage of male school-aged population enrolled in schools (supporting indicator)

6.5.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE Education is one of the most important aspects of human development. This indicator addresses the issue of educational opportunity by indicating how widespread formal education is in the city among school-aged population.

6.5.2 Supporting indicator requirements

The percentage of male school-aged population enrolled in schools shall be calculated as the number of male school-aged population enrolled at primary and secondary levels in public and private schools (numerator) divided by the total number of male school-aged population (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

The definitions of primary and secondary school detailed in 3.5 and 3.6 shall apply.

Enrolment in public and private schools should be reported, and cities shall note if private school data are included. In many cities, private schools are a significant component of education in the city. Private schools shall be recognized as providing real, bona fide education; many ministries or departments of

education have a program that recognizes such schools. Enrolment in religious schools and home schools should be included if they are recognized.

One part-time enrolment of a half-day or more shall be counted as a full-time enrolment.

If the geographies of school districts and the city are different, best judgment should be used to relate enrolment data to the city boundaries.

6.5.3 Data sources

Data on school enrolment should be obtained from local school boards, or the relevant Ministry or Department of Education. If enrolment data from these sources is not available, then data for enrolment from surveys or censuses may be used.

6.6 Percentage of school-aged population enrolled in schools (supporting indicator)

6.6.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE Education is one of the most important aspects of human development. This indicator addresses the issue of educational opportunity by indicating how widespread formal education is in the city among the school-aged population.

6.6.2 Supporting indicator requirements

The percentage of school-aged population enrolled in schools shall be calculated as the number of school-aged population enrolled in primary and secondary levels in public and private schools (numerator) divided by the total number of the school-aged population (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

Enrolment in public and private schools should be reported, and cities shall note in the comment section if private school data are included. In many cities, private schools are a significant component of education in the city. Private schools shall be recognized as providing real, bona fide education; many ministries or departments of education have a program that recognizes such schools. Enrolment in religious schools and home schools should be included if they are recognized.

Part-time enrolment of a half-day or more shall be counted as a full-time enrolment.

If the geographies of school districts and the city are different, best judgment should be used to relate enrolment data to the city boundaries.

6.7 Number of higher education degrees per 100 000 population (supporting indicator)

6.7.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE Education is a major component of well-being and is an indicator of economic development and quality of life. Receiving higher education provides individuals with a foundation for meaningful participation in the labour force and helps reduce poverty and inequality. This pillar of human development is widely recognized as the main avenue for social mobility.

6.7.2 Supporting indicator requirements

The number of higher education (tertiary education) degrees per 100 000 population shall be calculated as the number of people holding higher education degrees (numerator) divided by one 100 000th of the city's total population. The result shall be expressed as the number of higher degrees per 100 000 population.

6.7.3 Data sources

Data on school enrolment should be gathered from local school boards, or the relevant Ministry or Department of Education, if available. If enrolment data from these sources is not available, data from surveys or censuses may be used.

7 Energy

7.1 Total residential electrical energy use per capita (kWh/year) (core indicator)

7.1.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE An understanding of how much electricity is currently being consumed is needed in order to effectively manage generation, consumption, and conservation of electricity. Residential areas are one of the major consumers of electricity and its associated resource use. All forms of electricity generation have some level of environmental impact.

7.1.2 Core indicator requirements

Total residential electrical energy use per capita shall be calculated as the total residential electrical usage of a city in kilowatt hours (numerator) divided by

the total population of the city (denominator). The result shall be expressed as the total residential electrical use per capita in kilowatt hours/year.

7.1.3 Data sources

Data should be gathered from electricity providers. Electricity consumption statistics are typically collected in three categories, residential, commercial and industrial.

NOTE Electricity providers typically report electricity consumption statistics by customer and not by resident or they report consumption by sector (residential, commercial and industrial) in bulk and then report more detailed statistics as averages.

7.2 Percentage of city population with authorized electrical service (core indicator)

7.2.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE The percentage of city residents with lawful connection to the electricity supply system (the electricity grid) is an indicator of lawful provision of a basic urban service, which is of particular relevance to cities in less developed regions of the world. Electrical service is a contributing indicator of sustainability, resilience, economic productivity and health.

7.2.2 Core indicator requirements

The percentage of city population with authorized electrical service shall be calculated as the number of persons in the city with lawful connection to the electrical supply system (numerator) divided by the total population of the city (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

The number of city households lawfully connected to the electricity grid shall be multiplied by the current average city household size to determine the number of city residents with lawful connection to the electricity supply system (the electricity grid).

NOTE Most electricity supply authorities distinguish billing accounts to residential and non residential establishments. Residential establishments in most cities equate to households (although in some condominiums, the body corporate holds the account for multiple households).

7.3 Energy consumption of public buildings per year (kWh/m²) (core indicator)

7.3.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE Buildings are some of the largest energy consumers in cities. Reduced and effective energy use can create substantial savings and can enhance security of the energy supply. Reducing the energy consumption of a building can also reduce greenhouse gas emissions and its ecological footprint, which can help combat climate change and achieve a low carbon economy.

7.3.2 Core indicator requirements

Energy consumption of public buildings shall be calculated per year as the total use of electricity at final consumption stage by public buildings (kWh) within a city (numerator) divided by total floor space of these buildings in square meters (m^2) (denominator). The result shall be expressed as the total energy consumption of public buildings per year in kilowatt hours per square meter.

NOTE Public buildings are government owned buildings such as government offices, hospitals and schools.

7.4 The percentage of total energy derived from renewable sources, as a share of the city's total energy consumption (core indicator)

7.4.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE The promotion of renewable energy sources is a high priority for sustainable development, for reasons such as the security and diversification of energy supply and for environmental protection.

7.4.2 Core indicator requirements

The share of a city's total energy consumption derived from renewable sources shall be calculated as the total consumption of electricity generated from renewable sources (numerator) divided by total energy consumption (denominator). The result shall then be multiplied by 100 and expressed as a percentage. Consumption of renewable sources should include geothermal, solar, wind, hydro, tide and wave energy, and combustibles, such as biomass.

7.4.3 Data sources

Data available from local utility provider, city energy or environment office, and from various international sources, such as the International Energy Agency (IEA), and the World Bank.

7.4.4 Data interpretation

Renewable energy shall include both combustible and non-combustible renewables. Non-combustible renewables include geothermal, solar, wind, hydro, tide and wave energy. For geothermal energy, the energy quantity is the enthalpy of the geothermal heat entering the process. For solar, wind, hydro, tide and wave energy, the quantities entering electricity generation are equal to the electrical energy generated. The combustible renewables and waste (CRW) consist of biomass (fuelwood, vegetal waste, ethanol) and animal products (animal materials/waste and sulphite lyes), municipal waste (waste produced by the residential, commercial and public service sectors that are collected by local authorities for disposal in a central location for the production of heat and/or power) and industrial waste.

NOTE 1 The breakdown of energy consumption by source, if this data are available (i.e. % derived from fossil fuel; % derived from nuclear; % derived from renewables, etc.) should be noted.

NOTE 2 Data on particular renewables for a number of developing countries might be a limitation.

7.5 Total electrical energy use per capita (kWh/year) (supporting indicator)

7.5.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE An understanding of how much electricity is currently being consumed is needed in order to effectively manage generation, consumption, and conservation of electricity. Electricity is used to produce goods and services that are needed for economic growth and improved quality of life. Total electrical consumption reflects the overall consumption used by commercial, industrial, and residential sectors. All forms of electricity generation have some level of environmental impact.

7.5.2 Supporting indicator requirements

Total electrical energy use per capita shall be calculated as the total electrical usage of a city in kilowatt hours including residential and non-residential use (numerator) divided by the total population of the city (denominator). The result shall be expressed as the total electrical use per capita in kilowatt hours/year.

7.5.3 Data sources

Data shall be gathered from electricity providers. Electricity consumption statistics are typically collected in three categories: residential, commercial and industrial.

NOTE Electricity providers typically report electricity consumption statistics by customer and not by resident or they report consumption by sector (residential, commercial and industrial) in bulk and then report more detailed statistics as averages.

7.5.4 Data interpretation

Compilation of the sources used to generate energy based on fossil and renewable energy sources; types of renewable energy already in use; identification of locally existing renewable energy sources; compilation of the energy required for heating and cooling processes; completed and planned measures to save energy and to improve energy efficiency; completed and planned activities for the environmentally friendly insulation and cooling of buildings, if available should be noted.

7.6 Average number of electrical interruptions per customer per year (supporting indicator)

7.6.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE Average number of electrical interruptions helps to track and benchmark reliability performance in electric utility services.

7.6.2 Supporting indicator requirements

The average number of electrical interruptions per customer per year shall be calculated as the total number of customer interruptions (numerator) divided by the total number of customers served (denominator). The result shall be expressed as the average number of electrical interruptions per customer per year.

Electrical interruptions shall include both residential and non-residential.

It is normal to expect interruptions in service for a number of reasons including scheduled maintenance and equipment breakdown. To establish the opportunity to have a reasonable comparison between energy providers, major storms

and weather events should be excluded due to their unpredictability and randomness since they are difficult to predict, prevent or mitigate against.

NOTE This indicator is affected by the age, standard of maintenance and reliability of the infrastructure that constitutes the electricity grid and the electricity transmission capacity that services the grid. The ability of both the grid and its electricity transmission capacity to provide supply on demand and to cope with peak loads is also an important consideration.

7.7 Average length of electrical interruptions (in hours) (supporting indicator)

7.7.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE Average length of electrical interruptions helps to track and benchmark reliability performance in electric utility services.

7.7.2 Supporting indicator requirements

The average length of electrical interruptions shall be calculated as the sum of the duration of all customer interruptions in hours (numerator) divided by the total number of customer interruptions (denominator). The result shall be expressed as the average length of electrical interruptions in hours.

Electrical interruptions shall include both residential and non-residential.

It is normal to expect interruptions in service for a number of reasons including scheduled maintenance and equipment breakdown. To establish the opportunity to have a reasonable comparison between energy providers, major storms and weather events shall be excluded due to their unpredictability as they are difficult to prevent or mitigate against.

NOTE This indicator is affected by the age, standard of maintenance and reliability of the infrastructure that constitutes the electricity grid and the electricity transmission capacity that services the grid. The ability of both the grid and its electricity transmission capacity to provide supply on demand and to cope with peak loads is also an important consideration.

8 Environment

8.1 Fine particulate matter (PM2.5) concentration (core indicator)

8.1.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE Fine particulate matter can cause major health problems in cities. According to the WHO, any concentration of particulate matter (PM) is harmful to human health. PM is carcinogenic and harms the circulatory system as well as the respiratory system. As with many other air pollutants, there is a connection with questions of environmental justice, since often underprivileged citizens may suffer from stronger exposure. The evidence on PM and its public health impact is consistent in showing adverse health effects at exposures that are currently experienced by urban populations in both developed and developing countries. The range of health effects is broad, but are predominantly to the respiratory and cardiovascular systems.

8.1.2 Core indicator requirements

Fine particulate matter (PM2.5) concentration shall be calculated as the total mass of collected particles that are 2.5 microns or less in diameter (numerator) divided by the volume of air sampled (denominator). The result shall be expressed as the concentration of PM2.5 in micrograms per standard cubic meter (µg/m3).

The method for measurement shall involve the use of an air sampler which draws ambient air at a constant flow rate into a specially shaped inlet where the suspended particulate matter is inertially separated into one or more size fractions within the PM2.5 size range. The 24-hour (daily) measurements of PM2.5 concentrations are forwarded to a database where yearly summaries for each monitoring stations are computed.

NOTE Since data for PM2.5 is not readily available, levels are often calculated on the basis of PM10 emission and this is reported as a separate indicator.

8.2 Particulate matter (PM10) concentration (core indicator)

8.2.1 General

Those implementing this International Standard shall report on this indicator (unless reporting on PM2.5 under 8.1) in accordance with the following requirements.

NOTE The evidence on airborne Particulate Matter (PM) and its public health impact is consistent in showing adverse health effects at exposures that are currently experienced by urban populations in both developed and developing countries. PM pose a health concern because they can be inhaled into and accumulate in the respiratory system.

People with heart or lung disease, older adults, and children are considered at greater risk to particle pollution. Long-term exposures (annual mean) to particles, such as those experienced by people living for many years in areas with high particle levels, have been associated with problems such as reduced lung function and the development of chronic bronchitis - and even premature death. Short-term exposures (24 h) to particles can aggravate lung diseases, causing asthma attacks and acute bronchitis, and may also increase susceptibility to respiratory infections. High particle pollution in major cities have major negative impacts on economic/business growth due to decline in foreign investors. According to the World Health Organization,[12] air pollution is estimated to cause approximately 2 million premature deaths worldwide per year. In many cities, the average levels of PM10 exceed 70 µg per cubic meter (µ/m3).

8.2.2 Core indicator requirements

Particulate Matter (PM10) concentration shall be calculated as the total mass of collected particles in the PM10 size range (numerator) divided by the volume of air sampled (denominator). The result shall be expressed as the concentration of PM10 in micrograms per standard cubic meter (µg/m3).

The method for measurement shall involve the use of an air sampler which draws ambient air at a constant flow rate into a specially shaped inlet where the suspended particulate matter is inertially separated into one or more size fractions within the PM10 size range. The 24-hour (daily) measurements of PM10 concentrations are forwarded to a database where yearly summaries for each monitoring stations are computed.

NOTE Particulate matter is a mixture of microscopic solids and liquid droplets suspended in air. These particulates are made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, soil or dust particles, and allergens (such as fragments of pollen or mould spores). Coarse particles are greater than 2,5 microns and less or equal to 10 microns in diameter and are defined as “respirable particulate matter” or PM10. Sources of coarse particles include crushing or grinding operations, and dust from paved or unpaved roads.

8.3 Greenhouse gas emissions measured in tonnes per capita (core indicator)

8.3.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE The greenhouse gas emissions from all activities within the city are an indicator of the adverse contribution the city is making to climate change.

8.3.2 Core indicator requirements

The greenhouse gas emissions measured in tonnes per capita shall be measured as the total amount of greenhouse gases in tonnes (equivalent carbon dioxide units) generated over a calendar year by all activities within the city, including indirect emissions outside city boundaries (numerator) divided by the current city population (denominator). The result shall be expressed as the total greenhouse gas emissions per capita in tonnes.

The total aggregate tonnage (expressed as equivalent carbon dioxide units of greenhouse gas) of greenhouse gas emissions shall be calculated for all activities within the city for the preceding 12 months.

The Global Protocol for Community-Scale GHG Emissions (GPC), (2012 Accounting and Reporting Standard) refers to a multi-stakeholder consensus-based protocol for developing international recognized and accepted community-scale greenhouse gas accounting and reporting. This protocol defines the basic emissions sources and categories within sectors for a community-scale GHG inventory, in order to standardize GHG inventories between communities and within a community over time. The protocol provides accounting methodologies and step-by-step guidance on data collection, quantification, and reporting recommendations for each source of emissions.

Both emissions sources and sector categorizations reflect the unique nature of cities and their primary emissions sources. These include emissions from: 1) Stationary units, 2) Mobile units, 3) Waste, and 4) Industrial process and product use sectors. For further specifications, refer to the full GPC methodology. Local governments shall be expected to provide information (i.e., quantified emissions) for each of these emission sources.

In order to address the issue of inter-city sources of emissions that transcend more than one jurisdictional body, the GPC integrates the GHG Protocol Scope definitions, as follows:

Scope 2 emissions: Energy-related indirect emissions that result as a consequence of consumption of grid-supplied electricity, heating and/or cooling, within the community's geopolitical boundary.

Scope 3 emissions: All other indirect emissions that occur as a result of activities within the community's geopolitical boundary.

For step-by-step guidance on data and accounting collection, see Section 3 of the GPC. http://www.ghgprotocol.org/files/ghgp/GPC%20v9%2020120320.pdf

NOTE Greenhouse gases (GHGs) are gases in the atmosphere that absorb infrared radiation that would otherwise escape to space; thereby contributing to rising surface temperatures. There are six major GHGs: carbon dioxide (CO_2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6). The warming potential for these gases varies from several years to decades to centuries.

Users may also consult the ISO 14064 series[82] on *Greenhouse Gases* for further guidance.

8.4 NO_2 (nitrogen dioxide) concentration (supporting indicator)

8.4.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE NO_2 (nitrogen dioxide) is a major air pollutant, which can have significant impacts on human health and the environment. NO_2 contributes to the formation of photochemical smog and at raised levels can increase the likelihood of respiratory problems. Nitrogen dioxide inflames the lining of the lungs, and it can reduce immunity to lung infections. This can cause problems such as wheezing, coughing, colds, flu and bronchitis. Increased levels of nitrogen dioxide can have significant impacts on people with asthma because it can cause more frequent and more intense attacks. NO_2 chemically transforms into nitric acid and contributes to acid rain. Nitric acid can corrode metals, fade fabrics, and degrade rubber. When deposited, it can also contribute to lake acidification and can damage trees and crops, resulting in substantial losses.

8.4.2 Supporting indicator requirements

NO_2 concentration shall be calculated as the sum of daily concentrations for whole year (numerator) divided by 365 days (denominator). The result shall be expressed as the annual average for daily NO_2 concentration in µg/m3. The daily concentrations shall be determined by averaging the hourly concentrations throughout a 24 hour period from all monitoring stations within the city.

NOTE If the local air quality monitoring station measures NO_2 in parts per billion, the following conversion ratio to µg/m3 can be used: 1 ppb = 1.88 µg/m3. The conversion assumes an ambient pressure of 1 atmosphere and a temperature of 25 degrees °C. The general equation is µg/m3 = (ppb)*(12.187)*(M) / (273.15 + °C) where M is the molecular weight of the gaseous pollutant. An atmospheric pressure of 1 atmosphere is assumed.

Users of this standard should also note the frequency of NO_2 exposures. Peak exposure is determined by calculating the number of times the hourly mean exceeded 200 µg/m3 of NO2 in a calendar year. Long-term exposure is determined by calculating the number of times the daily mean exceeded 40 µg/m3 of NO_2 in a calendar year.

8.4.3 Data sources

Hourly average concentrations are measured by monitoring equipment and reported to Air Quality monitoring authority (i.e., City Environment Office, National Environment Office, etc.)

8.5 SO_2 (sulphur dioxide) concentration (supporting indicator)

8.5.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE SO_2 (sulphur dioxide) is a major air pollutant, which can have significant impacts on human health and the environment. Health effects caused by exposure to high levels of SO_2 include breathing problems, respiratory illness, changes in the lung's defenses, and worsening respiratory and cardiovascular disease. People with asthma or chronic lung or heart disease are the most sensitive to SO_2. It also damages trees and crops. SO_2, along with nitrogen oxides, are the main precursors of acid rain. This contributes to the acidification of lakes and streams, accelerated corrosion of buildings, reduced visibility and deforestation. SO_2 also causes formation of microscopic acid aerosols, which have serious health implications as well as contributing to climate change.

8.5.2 Supporting indicator requirements

SO_2 concentration shall be calculated as the sum of daily concentrations for the whole year (numerator) divided by 365 days. The result shall be expressed as the annual average for daily SO_2 concentration in $\mu g/m^3$. The daily concentration shall be determined by averaging the hourly concentrations throughout a 24 hour period from all monitoring stations within the city.

Users of this standard should also note the frequency of SO_2 exposures. Peak exposure is determined by calculating the number of times the 10 minute mean exceeded 500 $\mu g/m^3$ of SO2 in a calendar year. Long-term exposure is determined by calculating the number of times the daily mean exceeded 20 $\mu g/m^3$ of SO_2 in a calendar year.

NOTE If the local air quality monitoring stations measure SO_2 in parts per billion the following conversion ratio to µg/m3: 1 ppb = 2.62 µg/m3 shall be used. The conversion assumes an ambient pressure of 1 atmosphere and a temperature of 25 degrees Celsius. The general equation is µg/m3 = (ppb)*(12.187)*(M) / (273.15 + °C) where M is the molecular weight of the gaseous pollutant. An atmospheric pressure of 1 atmosphere is assumed.

8.5.3 Data Sources

Hourly average concentrations are measured by monitoring equipment and reported to Air Quality monitoring authority (i.e., City Environment Office, National Environment Office, etc.).

8.6 O_3 (Ozone) concentration (supporting indicator)

8.6.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE High concentrations of ozone in the ambient air are harmful for humans as well as plants. High concentrations of ozone can irritate the respiratory system and are linked to asthma, bronchitis and heart attacks. The elderly are especially vulnerable. There are links being made to ozone concentration and environmental justice, in particular with reference to underprivileged social groups with higher exposure and vulnerability.

8.6.2 Supporting indicator requirements

O_3(ozone) concentration shall be calculated as the sum of daily concentrations for the whole year (numerator) divided by 365 days (denominator). The result shall be expressed as the annual average for daily O_3 (ozone) concentration in µg/m3. O_3 is normally monitored at 8- hour intervals. To determine the 24 hour average daily concentration, the three 8 hour concentrations shall be determined and averaged over a 24 hour period at all monitoring stations within the city's boundaries.

NOTE If local stations monitor O_3 in parts per billion, the following conversion ratio to µg/m3 shall be used: 1 ppb = 2.00 µg /m3. The conversion assumes an ambient pressure of 1 atmosphere and a temperature of 25 degrees Celsius. The general equation is µg/m3 = (ppb)*(12.187)*(M) / (273.15 + °C) where M is the molecular weight of the gaseous pollutant. An atmospheric pressure of 1 atmosphere is assumed.

Long-term exposure shall be determined by the number of days when the daily average concentration over an 8 hour exposure exceeds 100 µg/m3. Long-term exposure shall be noted.

8.7 Noise pollution (supporting indicator)

8.7.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE Prolonged exposure to noise can lead to significant health effects, both physical and mental.

8.7.2 Supporting indicator requirements

Noise pollution shall be calculated by mapping the noise level L_{den} (day-evening-night) likely to cause annoyance as given in ISO 1996-2:1987, identifying the areas of the city where L_{den} is greater than 55 dB(A) and estimating the population of those areas as a percentage of the total city population. The result shall be expressed as the percentage of the population affected by noise pollution.

Users of this standard should note that noise pollution can also be recorded as L_n (night) and when exceeding 50 dB(A) is likely to cause sleep deprivation.

NOTE Another useful indicator of the noise levels in a city is the degree of annoyance as specified in ISO/TS 15666:2003.

8.7.3 Data sources

Average concentrations are measured by monitoring equipment and reported to Air Quality monitoring authority (i.e., City Environment Office, National Environment Office, etc.)

8.8 Percentage change in number of native species (supporting indicator)

8.8.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE Urbanization affects biodiversity through urban sprawl/habitat fragmentation, loss of fertile agricultural lands, and spread of invasive alien species. A loss in biodiversity threatens food supplies, lessens opportunities for recreation and tourism, and impacts a diverse range of medicinal sources, varieties of wood, and energy. It also interferes with essential ecological function, such as carbon sequestration and air filtering. The net change in the number of native species in a municipality is an indication of biological diversity loss or gain.

8.8.2 Supporting indicator requirements

The percentage change in number of native species shall be calculated as the total net change in species (numerator) divided by the total number of species from the 5 taxonomic groups from most recent survey (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

The net change in species shall be calculated as the number of new species within the city from the three core taxonomic groups and the city's selection of an additional two taxonomic groups (as a result of re-introduction, rediscovery, new species found, etc.) subtracted by the number of species that have become extirpated or locally extinct within the city.

The three core taxonomic groups shall refer to vascular plants, birds and butterflies. Additional taxonomic groups that cities should select can include the following: mammals, insects, bryophytes, fungi, amphibians, reptiles, freshwater fish, molluscs, dragonflies, carabid beetles, spiders, hard corals, marine fish, seagrasses, sponges, etc. A full list can be found in the User's Manual for the City Biodiversity Index.[83]

8.8.3 Data sources

Possible sources of data include government agencies in charge of biodiversity, city municipalities, urban planning agencies, city forestry departments, biodiversity centres, nature groups, universities, etc.

9 Finance

9.1 Debt service ratio (debt service expenditure as a percentage of a municipality's own-source revenue) (core indicator)

9.1.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE Widely accepted as a measure of sound financial management, this indicator reflects the amount of financial resources that are available for day-to-day operations and how much money is spent paying down debt. It can be a controllable cost and can assist in priority setting.

9.1.2 Core indicator requirements

Debt service ratio is the ratio of debt service expenditures as a per cent of a municipality's own source revenue. Debt service ratio shall be calculated as the total long-term debt servicing costs including lease payments, temporary financing and other debt charges (numerator) divided by total own source revenue (denominator). The result shall then be multiplied by 100 and expressed as a percentage of debt service expenditure as a percent of a municipality's own-source revenue.

Total own source revenue shall be calculated as the total revenue less transfers.

9.1.3 Data interpretation

A lower number may indicate either an increased ability to borrow or a decision by a municipality to limit its debt to enable funding of other service areas.

Care must be used in evaluating this indicator. A high debt service ratio may indicate a municipality that has taken on too much debt but it may also indicate that the municipality has taken an aggressive approach to debt repayment and is paying down their debt quickly. Similarly, a low debt service ratio could indicate a municipality is strong financially and can finance most capital projects through alternative funding sources. It may also indicate that a municipality is financially weaker and has deferred capital projects and allowed important infrastructure to deteriorate.

9.2 Capital spending as a percentage of total expenditures (supporting indicator)

9.2.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE The amount of capital expenditure by the city expressed as a percentage of the total city expenditure is an indicator of capital re-investment and the fiscal health of the city.

9.2.2 Supporting indicator requirements

The capital spending as a percentage of total expenditures shall be calculated as the total expenditure on fixed assets in the preceding year (numerator) divided by the total expenditure (operating and capital) (denominator) by the city in that same period. The result shall then be multiplied by 100 and expressed as a percentage of capital spending as a percent of total expenditures.

NOTE Fixed assets are not expected to be consumed or converted into cash in the normal course of business. They are long-term, more permanent or "fixed" items, such as land, building, equipment, fixtures, furniture, and leasehold improvements.

9.2.3 Data sources

The figures used in this calculation should to be taken directly from the city's audited financial statements without amendment or variation.

9.2.4 Data interpretation

This indicator needs to be considered in conjunction with the debt service ratio indicator to obtain an understanding of the city's capacity to maintain its capital expenditure. The level of capital expenditure in relation to recurrent expenditure may reflect the city's financial capacity to invest in capital items needed to support future growth and development.

9.3 Own-source revenue as a percentage of total revenues (supporting indicator)

9.3.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE On a very basic level, this indicator measures the level of dependence of the city on other levels of government for revenues to deliver its services to the public.

The balance between own source of income and senior level government transfers provides an indication of a city's viability, independence and control over its

own resources and can reveal , a city's ability to be effective in financial planning and management..

9.3.2 Supporting indicator requirements

Own-source revenue as a percentage of total revenues shall be calculated as the total amount of funds obtained through permit fees, user charges for city services, and taxes collected for city purposes only (numerator), divided by all operating or re-occurring revenues including those provided by other levels of government transferred to the city (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

Own-source revenue as a percentage of total revenues represent the percentage of local government revenues originating from fees, charges and taxes as permitted by law or legislation in relation to all revenues including those provided by other levels of government, (which includes operating or re-occurring revenues determined through methods such as formula driven payments or repatriation of income tax, grant donations from higher government levels including national or state governments and other types of financial transfers that may be tied to the delivery of specific services.

9.4 Tax collected as a percentage of tax billed (supporting indicator)

9.4.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE Tax collection is a major source of income for all levels of government including cities. This indicator is intended to measure the effectiveness of a city's financial management capabilities and to some extent is a proxy of the willingness of citizens to pay taxes.

9.4.2 Supporting indicator requirements

The tax collected as a percentage of tax billed measures the ratio of the actual tax collected to the mandated tax. It shall be calculated as the total revenues generated by tax collection (numerator) divided by the amount of taxes billed (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

10 Fire and emergency response

10.1 Number of firefighters per 100 000 population (core indicator)

10.1.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE Fire response is one of the fundamental services that all cities provide in its role of protecting life and property of its citizens.

10.1.2 Core indicator requirements

The number of firefighters per 100 000 population shall be calculated as the total number of paid full-time firefighters (numerator) divided by one 100 000th of the city population (denominator). The result shall be expressed as the number of firefighters per 100 000 population.

A firefighter shall refer to a full-time operational staff member located in the fire suppression unit that regularly responds to daily calls, and shall not include staff from fire prevention, safety, training, administration, senior management not directly involved in fire suppression, communication and dispatch.

This indicator is only intended to identify the number of paid fire fighters engaged in fire suppression or directly related activities. This indicator shall not include volunteer firefighters and shall be reported as a separate indicator.

NOTE The choice of 100 000 population was chosen to permit cities of different sizes to be able to compare results with each other relatively easily and effectively. It should be noted that in some countries this statistic is typically collected per 1000 capita and a slight mathematical adjustment may be necessary to reflect this difference to obtain an accurate comparison.

10.2 Number of fire related deaths per 100 000 population (core indicator)

10.2.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE One of the many measures used to demonstrate the effectiveness of a city's fire services is the number of fire related deaths that occur on an annual basis.

10.2.2 Core indicator requirements

The number of fire related deaths per 100 000 population shall be expressed as the number of deaths directly attributed to a fire incident with death occurring

within 30 days. This indicator shall be calculated as the total number of citizen fire related deaths recorded in a 12 month period (numerator), divided by one 100 000th of the city's total population (denominator). The result shall be expressed as the number of fire related deaths per 100 000 population.

NOTE Some of the factors that can influence the rate of fatalities in a city include: Age and density of housing, fire prevention and education efforts, socio-demographics, enforcement of Fire Code, and presence of working smoke detectors and alarm systems.[35]

10.3 Number of natural disaster related deaths per 100 000 population (core indicator)

10.3.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE The attractiveness of cities for citizens and investors alike, is affected by the frequency and magnitude of natural disasters occurring within a city and a city's ability to respond. The natural disaster related losses of lives in the past can be indicative of a city's potential future exposure.

10.3.2 Core indicator requirements

The number of natural disaster related deaths per 100 000 population shall be expressed as the number of deaths directly attributed to natural disaster incidents. This indicator shall be calculated as the total number of natural disaster related deaths recorded in a 12 month period (numerator), divided by one 100 000th of the city population (denominator). The result shall be expressed as the number of natural disaster related deaths per 100 000 population.

NOTE As natural disasters are generally not restricted to the exact geographic confines of a city, disaster database content may need slight readjustment/recalculation to produce results matching a given city's defined geographic boundary.

10.3.3 Data sources

Insurance companies and disaster management agencies are key providers of such data

10.3.4 Data interpretation

This indicator can be expanded beyond fatalities. Monetary losses can also be assessed as a result of natural disasters. This data is often available from insurance companies.

10.4 Number of volunteer and part-time firefighters per 100 000 population (supporting indicator)

10.4.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE Fire response is a fundamental service for protecting life and property of citizens. While many larger cities (25 000 or more people) are served by full time firefighters, many communities are also protected by volunteer firefighters. Volunteer firefighters are often located in smaller, rural departments.

10.4.2 Supporting indicator requirements

The number of volunteer and part time firefighters per 100 000 population shall be calculated as the total number of volunteer and part time firefighters (numerator) divided by one 100 000th of city's total population (denominator). The result shall be expressed as the number of volunteer and part time firefighters per 100 000 population.

Volunteer firefighters shall refer to individuals who respond to incidents without pay.

Part-time firefighters shall refer to individuals who are not considered full time career firefighters and are paid only for incidents that they respond to.

NOTE The term "volunteer" may be used in reference to a group of part-time or on call firefighters who may have other occupations when not engaged in occasional firefighting. Therefore, volunteer and part time firefighters are considered to be the same classification.

10.5 Response time for emergency response services from initial call (supporting indicator)

10.5.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE The average response time (in minutes and seconds) it takes an emergency and rescue department to respond to an initial distress call is an indicator of how protected a city's residents are from security and safety threats.

10.5.2 Supporting indicator requirements

The response time for the emergency and rescue department from the initial call shall be calculated as the sum of all initial distress calls to the on-site arrival of the emergency personnel and equipment in minutes and seconds for the year (numerator) divided by the number of emergency responses in the

same year (denominator). The result shall be expressed as the response time for emergency response services from initial call in minutes and seconds.

The total number of minutes and seconds taken to respond to all emergency rescue calls shall include the time elapsed from receiving the initial call for assistance to arrival on-site of emergency personnel and equipment is calculated for the preceding 12 months.

NOTE Because it has the appearance of objectivity, emergency response time is a valuable key operational measure used to assess system performance from the citizen's perspective.

10.6 Response time for fire department from initial call (supporting indicator)

10.6.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE The average response time (in minutes and seconds) it takes a fire department to respond to an initial distress call is an indicator of how protected a city's residents are from fires and emergencies.

10.6.2 Supporting indicator requirements

The response time for a fire department from the initial call shall be calculated as the sum of all initial distress calls to the on-site arrival of the fire department personnel and equipment in minutes and seconds for the year (numerator) divided by the number of fire department responses in the same year (denominator). The result shall be expressed as the response time for fire department from initial call in minutes and seconds.

The total number of minutes and seconds taken to respond to all emergency calls shall include the time elapsed from receiving the initial call for assistance to the on-site arrival of fire department personnel and equipment and is calculated for the preceding 12 months.

NOTE Because it has the appearance of objectivity, response time is a valuable and key operational measure used to assess system performance from the citizen's perspective

11 Governance

11.1 Voter participation in last municipal election (as a percentage of eligible voters) (core indicator)

11.1.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE The percentage of the eligible voting population that voted in the last municipal election is an indicator of the public's level of participation and degree of interest in local government.

11.1.2 Core indicator requirements

The voter participation in the last municipal election shall be calculated as the number of persons that voted in the last municipal election (numerator) divided by the city population eligible to vote (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

A result of zero shall be indicated if there have been no municipal elections in the last five years and this shall be noted in the comments.

In countries where voting is mandatory, the per cent of votes (ballots) that are not blank or spoiled shall be reported. This will indicate the share of positive voter participation.

There is a distinction between eligible to vote and registered to vote. In some countries people have to register (actively) in order to be allowed to vote. In all other countries, eligible and registered voters are one and the same. This should be noted.

11.1.3 Data sources

Information should be obtained from the local authorities, officials or the Ministry responsible for local governments.

11.1.4 Data interpretation

This indicator will only reveal the level of participation, not the level of satisfaction of the population. In some cases, high rates of participation will mean that the population is not satisfied with its local government's leadership and actions.

11.2 Women as a percentage of total elected to city-level office (core indicator)

11.2.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE The percentage of women elected to city-level office is a direct reflection of inclusiveness in governance.

11.2.2 Core indicator requirements

The number of women elected to city-level office shall be calculated as the total number of elected city-level positions held by women (numerator) divided by the total number of elected city-level positions (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

The number of elected city-level positions shall refer to the number of places on the city council or in city government that are directly elected. This shall include elected managerial roles such as Sherriff and Comptroller, where relevant.

11.3 Percentage of women employed in the city government workforce (supporting indicator)

11.3.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE The percentage of the city government workforce that is women is a direct reflection of the equity of the hiring system within the city government.

11.3.2 Supporting indicator requirements

The number of women employed in the city government workforce shall be calculated as the total number of employees in the city government workforce that are women (numerator) divided by the total number of the city government workforce (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

The city government workforce shall be calculated as the total number of employees working within the city government.

11.4 Number of convictions for corruption and/or bribery by city officials per 100 000 population (supporting indicator)

11.4.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE The principles of governance include selflessness, objectivity, accountability, openness, honesty and leadership. The number of convictions for corruption/bribery can reflect the extent to which governance adheres to these core principles.

11.4.2 Supporting indicator requirements

The number of convictions for corruption and/or bribery by city officials shall be calculated as the total number of convictions for corruption and/or bribery by city officials (numerator) divided by one 100 000th of the city's total population (denominator). The result shall be expressed as the number of convictions for corruption and/or bribery by city officials per 100 000 population.

City officials are the elected or employed representatives of the city.

11.5 Citizens' representation: number of local officials elected to office per 100 000 population (supporting indicator)

11.5.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE The number of public officials elected by citizens of the city and the right of citizens as guaranteed by law, to examine and then make submissions/objections to urban planning, development and infrastructure policies/plans/projects prior to their approval/construction is an indicator of citizens' rights to participate in the affairs of their city.

11.5.2 Supporting indicator requirements

The number of local officials elected to office per 100 000 shall be calculated as the total number of public officials elected to local office by citizens of the city (numerator) divided by one 100 000th of the city's total population (denominator). The result shall be expressed as the number of local officials elected to office per 100 000 population.

The term "public officials elected to local office by citizens of the city" shall include all positions in the public service relating to the city that require election by the citizens of the city to hold office. It includes all councils, boards,

commissions etc. where members are elected by the citizens of the city but does not include national or state government politicians.

NOTE This indicator only reveals the number of local officials elected to office and does not determine whether or not citizens have the right, guaranteed by law, to examine and then make submissions/objections to urban planning, development and infrastructure policies/plans/projects prior to their approval/construction. It is codified and enforceable law of the city that guarantees citizens the right to examine and then make submissions/objections to urban planning, development and infrastructure policies/plans/projects prior to their approval/construction in order for cities to report that this element of the citizens' participation exists in their city. Whether these rights exist should be noted.

11.5.3 Comments and limitations

An increase in elected city officials and a corresponding increase in city workers may in some circumstances indicate an expensive city administration.

11.6 Number of registered voters as a percentage of the voting age population (supporting indicator)

11.6.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE Determining the percentage of the number of registered voters from the voting age population can reveal the legitimacy and quality of the electoral process in a city. For citizens to exercise their democratic right to vote there must be a comprehensive and inclusive electoral register, also called a voters list; and this must be carefully maintained to ensure that each eligible citizen is registered to vote once and only once. A voters list makes it possible to separate two of the most important functions of the election authority: verifying voter eligibility and controlling the legitimacy of the balloting process.

11.6.2 Supporting indicator requirement

The number of registered voters as a percentage of the voting age population shall be calculated as the total number of registered voters, as determined by the official voter register (numerator) divided by the voting age population (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

Number of registered voters shall refer to the number of names on the voters' register at the time that the registration process closes (cut-off date), as reported by the election authority. The election authority should use one of three options for voter registration: a periodic list, a continuous register/ list, or a civil registry. Any one of these options can determine the number of registered voters.

Voting age population shall include all citizens of legal voting age.

NOTE Voting age population is not necessarily an exact measure of the number of citizens entitled to vote as it does not take into account legal or systemic barriers to the exercise of the franchise or account for non-eligible members of the population, such as resident non-citizens or in some jurisdictions persons serving a sentence of imprisonment in a penal or correctional institution (the voting eligible population – VEP – would capture these discrepancies but it is very hard to achieve the data required to measure VEP). However in some countries, non-citizens, such as immigrants have been granted the legal right to vote in municipal elections before they become citizens.

12 Health

12.1 Average life expectancy (core indicator)

12.1.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE Life expectancy reflects the overall mortality level of a population. Life expectancy is closely connected with health conditions, which are an integral part of development. Mortality is also one of the variables that determine the size of human populations and their potential for future growth. Life expectancy at birth is also a measure of overall quality of life in a country and summarizes mortality at all ages. It can also be thought of as indicating the potential return on investment in human capital and is necessary for the calculation of various actuarial measures.

12.1.2 Core indicator requirements

The average life expectancy shall be calculated as the average number of years to be lived by a group of people born in the same year, if health and living conditions at the time of their birth remained the same throughout their lives.[3][84]

12.2 Number of in-patient hospital beds per 100 000 population (core indicator)

12.2.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE The number of in-patient public hospital beds is one of the few available indicators which monitor the level of a health service delivery. Service delivery is an important part of health systems, and in-patient public hospital bed density is one of the few indicators that can be collected worldwide (WHO, 2006).[12]

12.2.2 Core indicator requirements

The number of in-patient hospital beds per 100 000 shall be calculated as the total number of in-patient public and private hospital beds (numerator), divided by one 100 000th of the city's total population (denominator). The result shall be expressed as the number of in-patient public and private hospital beds per 100 000 of the city population.

Hospital beds shall include in-patient and maternity beds. This shall include beds in wards which are closed for reasons such as lack of health staff, and building works. It shall also include beds for patients admitted who require continual assistance, incubators and specialized care. It may not include day care beds, pre-anaesthesia beds, wake-up beds, beds for members of a patient's family, and beds for hospital staff.[6]

12.2.3 Data sources

This indicator should rely on administrative records, based on reported data by public inpatient facilities. Data may also come from censuses of health care facilities.

12.3 Number of physicians per 100 000 population (core indicator)

12.3.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE The availability of physicians is an important indicator of the strength of a city's health system. There is evidence that the number of physicians is positively associated with immunization coverage, outreach of primary care, and infant, child and maternal survival (WHO, 2006).[12] In this standard physicians may also be referred to as doctors.

12.3.2 Core indicator requirements

The number of physicians per 100 000 population shall be calculated as the number of general or specialized practitioners whose work-place is in the city (numerator) divided by one 100 000th of the city's total population (denominator). The result shall be expressed as the number of physicians per 100 000 population.

For this indicator, a physician shall be defined as someone who graduates from any facility or school of medicine whose work-place is in the city.

FTE shall be applied, in order to capture doctors working part-time in hospitals and in practices.

12.3.3 Data sources

Cities should report the number of physicians based on administrative records such as registered physicians in the City. Information may also be obtained from the census, labour force statistics or other surveys which inquire about occupation.

The accuracy and completeness of the human resource data in countries can be a problem because databases are not updated frequently, private sector data are often not included and definitions of workers vary. It is for this reason that yearly updated data sources, such as administrative records, should be used. The definition presented above shall be the definition used when gathering data to report on this indicator.

12.4 Under age five mortality per 1 000 live births (core indicator)

12.4.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE The under age five mortality rate is a leading indicator of the level of child health and overall development in cities. Child mortality is an indicator of the status of the city as a healthy or unhealthy place to live. In addition, mortality rates are among the most frequently used indicators to compare levels of socioeconomic development across countries. Improving child mortality rates is a vital component of the Millennium Development Goals.[21]

12.4.2 Core indicator requirements

The under age five mortality per 1 000 live births shall refer to the probability of a child born in a specified year dying before reaching the age of five, and shall be expressed as a rate per 1 000 live births.

NOTE The under age five mortality rate, is strictly speaking, not a rate (i.e. the number of deaths divided by the number of population at risk during a certain period of time) but a probability of death derived from a life table and expressed as rate per 1 000 live births.

Age-specific mortality rates among children and infants shall be calculated from birth and death data derived from vital registration, census, and/or household surveys. Estimates based on household surveys data shall be obtained:

a) directly, using birth history, as in demographic and health surveys, or

b) indirectly, using the Brass method, as specified in the Multiple Indicator Cluster Surveys.[26]

The data shall then be summed for children under age five and shall be expressed as a rate per 1,000.

12.4.3 Data sources

At the city level, a complete vital statistics registration system covering at least 90 per cent of vital events in the population should be used, since these represent the best source of data. Such systems are uncommon in developing countries, so estimates may be obtained from sample surveys or derived by applying direct and indirect estimation techniques to registration, census or survey data.

NOTE In developing countries, household surveys are essential to the calculation of this indicator, but there are some limits to their quality. Survey data are subject to recall error, and surveys estimating under age five deaths require large samples, because such incidences are uncommon and representative households cannot ordinarily be identified by the sampling. Moreover, the frequency of the survey is generally only every three to five years. When using household surveys the user shall take sampling errors into account. Also, indirect estimates rely on estimated actuarial ("life") tables that may be inappropriate for the population concerned.

12.5 Number of nursing and midwifery personnel per 100 000 population (supporting indicator)

12.5.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE The number of nursing and midwifery personnel is a good indication of the city's health system and the strength of its outreach for maternal health.

12.5.2 Supporting indicator requirements

The number of nursing and midwifery personnel shall be calculated as the total number of nurses and midwives (numerator), divided by one 100 000th of the city's total population (denominator). The result shall be expressed as the number of nursing and midwifery personnel per 100 000 population.

The number of nurses shall include actively practicing nurses and midwives employed in public and private hospitals, clinics and other health facilities, including self-employed nurses and midwives. Both fully-qualified nurses with post-secondary education in nursing and vocational/associate/auxiliary/practical nurses with a lower level of nursing skills but also usually registered, shall be reported.

NOTE Some figures may be underestimated or overestimated when it is not possible to distinguish whether the data includes health workers in the private sector, double counts of health workers holding two or more jobs at different locations, health service providers working outside the health care sector (e.g. nurses working in a school or large private company), workers who are unpaid or unregulated but performing health care tasks (e.g. volunteer community health workers) or people with health vocational training who are not currently engaged in the national health labour market (e.g. unemployed, migrated, retired or withdrawn from the labour force for personal reasons).

12.6 Number of mental health practitioners per 100 000 population (supporting indicator)

12.6.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE Mental health is central to human development. Positive mental health is linked to a range of development outcomes, including better health status, higher educational achievement, enhanced productivity and earnings, improved interpersonal relationships, better parenting, closer social connections and improved quality of life. Positive mental health is also fundamental to coping with adversity.

On the other hand, poor mental health impedes an individual's capacity to realize their potential, work productively, and make a contribution to their community. The social and economic impact of mental and psychosocial disabilities is diverse and far-reaching, leading to homelessness, poor educational and health outcomes and high unemployment rates culminating in high rates of poverty. All these issues are directly linked to the Millennium Development Goals (MDGs).

12.6.2 Supporting indicator requirement

The number of mental health practitioners per 100 000 population shall be calculated as the total number of mental health practitioners whose work-place is in the city (numerator) divided by one 100 000th of the city's total population (denominator). The result shall be expressed as the number of mental health practitioners per 100 000 population.

Mental health practitioners shall refer to psychiatrists, clinical psychologists, clinical social workers, psychiatric nurses and mental health counsellors.

12.7 Suicide rate per 100 000 population (supporting indicator)

12.7.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE Suicide rate is a serious issue in many cities and reflects on mental health in a city which is central to human development.

12.7.2 Supporting indicator requirements

The number of deaths by suicide per 100 000 population shall be calculated as the total number of reported deaths by suicide (numerator) divided by one 100 000th of the city's total population (denominator). The result shall be expressed as the number of deaths by suicide per 100 000 population.

Death by suicide shall refer to acts deliberately initiated and performed by a person who fully acknowledges the fatal outcome of such acts.

12.7.3 Data sources

This information should be obtained from the coroner's office, regional health authority or national census.

NOTE Suicides are not always reported as such. In particular, suicides may sometimes be reported as homicides or accidents.

13 Recreation

13.1 Square meters of public indoor recreation space per capita (supporting indicator)

13.1.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE Recreation is an important aspect of city life, contributing to the health of citizens and the vitality of the city. Recreation is a service that many cities provide through a parks and recreation department or related office.

13.1.2 Supporting indicator requirements

Square meters of public indoor recreation space per capita shall be calculated as the square meters of indoor public recreation space (numerator) divided by the population of the city (denominator), and shall be expressed as the number of square meters of indoor recreation space per capita.

NOTE The need for indoor public recreational spaces varies depending on local climatic and cultural conditions.

Public recreation space is defined broadly to mean land and buildings open to the public for recreation. Recreation space shall include only space that primarily serves a recreation purpose.

Indoor public recreation space should include:

a) city-owned or maintained buildings;

b) other recreation buildings within the city not owned or operated by the city, provided they are open to the public. This category may include state or provincially owned buildings, schools and colleges, as well as non-profit. If cities report only city-owned recreation space, this shall be noted.

For multi-story buildings the floor area of all floors in the building should be counted if known.

For multi-use facilities only the portion of the building devoted to recreation shall be counted (the play areas at a school or college, for example, not the entire school site).

The area of the entire recreation site shall be included (including, for example, building maintenance and utility areas) but shall exclude parking areas.

NOTE Many cities report city-owned recreation space and this does not include the contribution to recreation from non-city-owned facilities. This may be very important in developing countries. While the methodology in this International Standard is more complex, the result will ultimately be more meaningful. It is recommended that a recreation space inventory be created.

13.1.3 Data sources

This information should be obtained from the City Planning Department together with departments knowledgeable about the city.

Recreation spaces may also be delineated using aerial photography and/or land use maps. Once the areas have been identified on a map, the area in square meters may be calculated using low cost Geographic Information Systems (GIS) or, if not available, through use of hand-held measuring devices. Area may be calculated in hectares or acres and converted to square meters.

13.2 Square meters of public outdoor recreation space per capita (supporting indicator)

13.2.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE Recreation is an important aspect of city life, contributing to the health of citizens and the vitality of the city. Recreation is a service that many cities provide through a parks and recreation department or related office. This will include outdoor recreation space.

13.2.2 Supporting indicator requirements

Square meters of public outdoor recreation space per capita shall be calculated as square meters of outdoor public recreation space (numerator) divided by the population of the city (denominator), and shall be expressed as the number of square meters of outdoor recreation space per capita.

Public recreation space is defined broadly to mean land and open space available to the public for recreation. Recreation space shall include only space that primarily serves a recreation purpose.

Outdoor recreation space should include:

a) city-owned or maintained land;

b) other-recreation lands within the city not owned or operated by the city, provided they are open to the public. This category may include state or provincially owned lands, school and college grounds, as well as non-profit. If cities report only city-owned recreation space, this shall be noted.

For multi-use facilities, only the portion of the land devoted to recreation shall be counted (the play areas at a school or college, for example, not the entire school site). Double counting shall be avoided. For example, do not include indoor facilities on parkland.

The area of the entire outdoor recreation site shall be included (including, for example wooded areas of parks, building maintenance and utility areas) but shall exclude parking areas.

NOTE Many cities report city-owned recreation space and this does not include the contribution to recreation from non-city owned facilities. This may be very important in developing countries. While the methodology in this International Standard is more complex, the result will ultimately be more meaningful. It is recommended that a recreation space inventory be created.

13.2.3 Data sources

This information should be obtained from a City Planning Department together with departments knowledgeable about the city.

Outdoor recreation spaces may also be delineated using aerial photography and/or land use maps. Once the areas have been identified on a map, the area in square meters may be calculated using low cost Geographic Information Systems (GIS) or, if not available, through use of hand-held measuring devices. Area may be calculated in hectares or acres and converted to square meters.

14 Safety

14.1 Number of police officers per 100 000 population (core indicator)

14.1.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE The number of sworn police officers per 100 000 population is an indicator of the overall crime prevention in place in a city.

14.1.2 Core indicator requirements

The number of police officers per 100 000 population shall be calculated as the number of permanent full-time (or full-time equivalent) sworn police officers (numerator) divided by one 100 000th of the city's total population

(denominator). The result shall be expressed as the number of police officers per 100 000 population.

Sworn law enforcement officers should meet the following criteria: work in an official capacity; have full arrest powers; carry identification; and, be paid from governmental funds set aside specifically for payment of sworn law enforcement representatives.

Each year, law enforcement agencies shall report the total number of sworn law enforcement officers as of a locally determined date. Personnel counts shall be based on permanent, FTE. Part-time employees can be converted to full-time equivalents (e.g. four employees working 10 h per week would equal one full-time employee working a 40 h week). Temporary officers shall not be included in this count.

14.1.3 Data sources

Data for this indicator should be gathered through police personnel information collected annually.

14.2 Number of homicides per 100 000 population (core indicator)

14.2.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE The number of homicides is an indicator of the amount of crime and an indicator of feelings of personal safety and can affect incentives to invest.

14.2.2 Core indicator requirements

The number of homicide per 100 000 population shall be calculated as the number of reported homicides (numerator) divided by one 100 000th of the city's total population (denominator). The result shall be expressed as the number of homicides per 100 000 population.

Homicide shall include intentional and non-intentional homicide. Intentional homicide shall refer to death deliberately inflicted on a person by another person, including infanticide. Non-intentional homicide shall refer to death non-deliberately inflicted on a person by another person. This shall include manslaughter, but shall exclude traffic accidents that result in the death of a person, and suicides.

14.2.3 Data sources

The data should be obtained from the police or other law enforcement agencies.

NOTE Homicides are not always reported as such. In particular, domestic homicides are sometimes reported as suicides or accidents.

14.3 Crimes against property per 100 000 (supporting indicator)

14.3.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE The number of property crimes is an indicator of the amount of criminal offences against privately-owned property and an indicator of feelings of personal safety and can affect incentives to invest. The number of property crimes in a city is considered a benchmark for the overall level of safety in the city. Because they have the appearance of objectivity, property crime statistics are a valuable key operational measure used to assess system performance concerning private space protection from the citizen's perspective.

14.3.2 Supporting indicator requirements

The number of crimes against property shall be calculated as the total number of all property crimes reported (numerator) divided by one 100 000th of the city's total population (denominator). The result shall be expressed as the number of property crimes per 100 000 population.

Crimes against property shall be defined as all offences involving the unlawful taking or destruction of property, but without the threat of use of force against a person.

Crime against property should include: burglary; larceny-theft; motor vehicle theft; and, arson.

14.4 Response time for police department from initial call (supporting indicator)

14.4.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE The average response time (in minutes and seconds) it takes a police department to respond to an initial distress call is an indicator of how protected a city's residents are from security and safety threats. Because it has the appearance of objectivity, police response time is a valuable and key operational measure used to assess system performance from the citizen's perspective.

14.4.2 Supporting indicator requirements

The response time for police department from initial call shall be calculated as the sum of number of all initial distress calls to the on-site arrival of the police department personnel for the year in minutes and seconds (numerator) divided by the number of police department responses in the same year (denominator). The result shall be expressed as the response time for police department from initial call in minutes and seconds.

The total number of minutes and seconds taken to respond to all emergency calls shall include the time elapsed from receiving the initial call for assistance to arrival on-site of police department personnel is calculated for the preceding 12 months.

14.5 Violent crime rate per 100 000 population (supporting indicator)

14.5.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE The number of violent crimes is an indicator of the amount of serious criminal offences in a City and a lead indicator of feelings of personal safety. The number of violent crimes in a city is considered a benchmark measure of the overall level of safety in the city.

14.5.2 Supporting indicator requirements

The violent crime rate per 100 000 population shall be calculated as the total number of all violent crimes reported (numerator) divided by one 100 000th of the city's total population (denominator). The result shall be expressed as the number of violent crimes per 100 000 population.

Violent crimes shall include offences that involve force or the threat of force to a person. Total violent crimes reported shall be calculated as the total sum of the number of murders and non-negligent manslaughters, the number of rapes, the number of robberies and the number of aggravated assaults.

Furthermore, a violent crime should be classified as one of the following four offences (in order of severity): murder and non-negligent manslaughter; rape; robbery; and, aggravated assault.

For a multiple-offence, only the most serious/severe offence shall be counted.

15 Shelter

15.1 Percentage of city population living in slums (core indicator)

15.1.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE The percentage of the population living in slums is an indicator of the number of city residents living in substandard or insecure housing. Evidence shows that slums are growing and becoming permanent features of urban landscapes. One out of every three city dwellers lives in a slum today. Since slums host significantly large proportions of the urban population it is important to measure them.

15.1.2 Core indicator requirements

The percentage of city population living in slums shall be calculated as the number of people living in slums (numerator) divided by the city population (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

The number of people living in slums shall be calculated as the number of slum households multiplied by current average household size.

Different cultures and countries define the physical and social attributes of slums differently. UN-HABITAT acknowledges this diversity and the fact that slums take many different forms and names.

A slum household shall refer to a group of individuals living under the same roof in an urban area who lack one or more of the following five conditions:

a) Durable housing: A house is considered "durable" if it is built on a non-hazardous location and has a structure permanent and adequate enough to protect its inhabitants from the extremes of climatic conditions, such as rain, heat, cold and humidity.

b) Sufficient living area: A house is considered to provide a sufficient living area for the household members if not more than three people share the same room.

c) Access to improved water: A household is considered to have access to improved water supply if it has a sufficient amount of water for family use, at an affordable price, available to household members without being subject to extreme effort, especially on the part of women and children.

d) Access to sanitation: a household is considered to have adequate access to sanitation if an excreta disposal system, either in the form of a private toilet or a public toilet shared with a reasonable number of people, is available to household members.

e) Secure tenure: Secure tenure is the right of all individuals and groups to effective protection against forced evictions. People have secure tenure when there is evidence of documentation that can be used as proof of secure tenure status or when there is either de facto or perceived protection against forced evictions.

Care should be taken to avoid double counting so as to not exaggerate or over-count the percentage of population in slums.

EXAMPLE A household that lacks access to improved water and does not have secured tenure should be counted as one slum household.

15.1.3 Data sources

Data for the above conditions should be gathered from census and survey data and information from agencies working with slums.

15.2 Number of homeless per 100 000 population (supporting indicator)

15.2.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE Having a home to live in can be considered a basic need. There may be several reasons for a homeless situation, such as the housing price to income ratio.[40]

15.2.2 Supporting indicator requirements

The number of homeless per 100 000 population shall be calculated as the total number of homeless people (numerator), divided by one 100 000th of the city's total population (denominator). The result shall be expressed as the number of homeless per 100 000 population.

The following definition is used by the United Nations[41] to define homelessness: Absolute homelessness refers to those without any physical shelter, for example, those living outside, in parks, in doorways, in parked vehicles, or parking garages, as well as those in emergency shelters or in transition houses for women fleeing abuse.

15.3 Percentage of households that exist without registered legal titles (supporting indicator)

15.3.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE Understanding the percentage of households that exist without registered legal titles informs municipal leaders on housing security for city residents as well as housing conditions, infrastructure requirements and builds a better database for less formal parts of the city.

15.3.2 Supporting indicator requirements

The percentage of households that exist without registered legal titles shall be calculated as the number of households that exist without registered legal titles (numerator) divided by the total number of households (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

Unregistered legal title includes the following tenure types: unregistered lease or leaseholds, rental, occupancy right, use right (including sub-lease, sub-rental and co-tenancy, and co-occupancy right).

16 Solid waste

16.1 Percentage of city population with regular solid waste collection (residential) (core indicator)

16.1.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE The percentage of the city population served by regular solid waste collection is an indicator of city health, cleanliness and quality of life. Solid waste systems contribute in many ways to public health, the local economy, the environment, and the social understanding and education about the latter.

16.1.2 Core indicator requirements

The percentage of city population with regular solid waste collection shall be calculated as the number of people within the city that are served by solid waste collection (numerator) divided by the total city population (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

The number of households in the city serviced with regular solid waste collection shall first be determined. The number of households being serviced by the regular solid waste collection service shall then be multiplied by the current

average household size for that city to determine the number of persons serviced with regular solid waste collection. Regular solid waste collection shall be defined as having the solid waste picked up from the household, transported and dropped at a proper treatment facility (recycling or landfill sites) on at least a weekly basis or every two weeks. If the solid waste is collected in any moving vehicle by persons that have not constituted a legally established entity, the house shall not be considered as a household serviced with a solid waste collection service.

NOTE Use of persons rather than city area as the metric for this indicator avoids the distortion arising from local government areas that include both urban and non-urban areas.

16.1.3 Data sources

Information should be obtained from the local operator(s) of solid waste collection systems, census data, and municipal waste facilities.

16.1.4 Data interpretation

Results will only indicate how much of the city population has access to solid waste collection systems, not the quality of the system: the quality of the service (street level), the levels of recycling (and of land fill misuse), or the capacity of the land fill to meet the demand. Some of these issues will be addressed in the supporting indicators.

The proper discharge, transportation and treatment of solid waste is one of the most important components of life in a city and one of the first areas in which governments and institutions should focus. Solid waste systems contribute in many ways to public health, the local economy, the environment, and the social understanding and education about the latter. A proper solid waste system can foster recycling practices that maximize the life cycle of landfills and create recycling micro-economies; and it provides alternative sources of energy that help reduce the consumption of electricity and/or petroleum based fuels.

16.2 Total collected municipal solid waste per capita (core indicator)

16.2.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE This indicator provides a measure of how much waste a city is producing and the level of service a city is providing for its collection. Higher levels of municipal waste contribute to greater environmental problems and therefore levels of collection, and also methods of disposal, of municipal solid waste are an important component of municipal environmental management. Collection of municipal solid waste is also an indicator of city management with regard to cleanliness, health and quality of life. Solid waste systems contribute in many ways to public health, the local economy, the environment, and the social understanding and education about the latter.

16.2.2 Core indicator requirements

The total collected municipal solid waste per capita shall be expressed as the total municipal solid waste produced in the municipality per person. This indicator shall be calculated as the total amount of solid waste (household and commercial) generated in tonnes (numerator) divided by the total city population (denominator). The result shall be expressed as total municipal solid waste collected per capita in tonnes.

Municipal waste shall refer to waste collected by or on behalf of municipalities.

The data shall only refer to the waste flows managed under the responsibility of the local administration including waste collected on behalf of the local authority by private companies or regional associations founded for that purpose.

Municipal waste should include waste originating from:

— households;

— commerce and trade, small businesses, office buildings and institutions (e.g. schools, hospitals, government buildings).

The definition should also include:

— bulky waste (e.g. white goods, old furniture, mattresses);

— garden waste, leaves, grass clippings, street sweepings, the content of litter containers, and market cleansing waste, if managed as waste;

— waste from selected municipal services, i.e. waste from park and garden maintenance, waste from street cleaning services (e.g. street sweepings, the content of litter containers, market cleansing waste), if managed as waste.

The definition shall exclude:

— waste from municipal sewage network and treatment;

— municipal construction and demolition waste.

16.2.3 Data interpretation

The proper discharge, transportation and treatment of solid waste is one of the most important components of life in a city and one of the first areas in which governments and institutions should focus. Solid waste systems contribute in many ways to public health, the local economy, the environment, and the social understanding and education about the latter. A proper solid waste system can foster recycling practices that maximize the life cycle of landfills and create recycling micro-economies; and it provides alternative sources of energy that help reduce the consumption of electricity and/or petroleum based fuels.

16.3 Percentage of the city's solid waste that is recycled (core indicator)

16.3.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE Many cities generate more solid waste than they can dispose of. Even when municipal budgets are adequate for collection, the safe disposal of collected waste often remains a problem. Diverting recyclable materials from the waste stream is one strategy for addressing this municipal issue. Higher levels of municipal waste contribute to greater environmental problems and therefore levels of collection, and also methods of disposal, of municipal solid waste are an important component of municipal environmental management. Solid waste systems contribute in many ways to public health, the local economy, the environment, and the social understanding and education about the latter. A proper solid waste system can foster recycling practices that maximize the life cycle of landfills and create recycling micro-economies; and it provides alternative sources of energy that help reduce the consumption of electricity and/or petroleum based fuels.

16.3.2 Core indicator requirements

The percentage of the city's solid waste that is recycled shall be calculated as the total amount of the city's solid waste that is recycled in tonnes (numerator) divided by the total amount of solid waste produced in the city in tonnes (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

Recycled materials shall denote those materials diverted from the waste stream, recovered, and processed into new products following local government permits and regulations (International Solid Waste Association, ISWA[23]).

Hazardous waste that is produced in the city and is recycled shall be reported separately.

16.3.3 Data sources

This information should be obtained from municipal bodies, public services and major private contractors dealing with solid waste collection and disposal. Data

may be obtained from specific studies carried out on solid waste for specific projects.

Information on selected disposal methods should be gathered from municipal facilities and operators, parastatal and private companies dealing with solid waste treatment. Solid waste experts, as well as NGOs working in this area, may be consulted.

16.4 Percentage of the city's solid waste that is disposed of in a sanitary landfill (supporting indicator)

16.4.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE Many cities generate more solid waste than they can dispose of. Even when municipal budgets are adequate for collection, the safe disposal of collected waste often remains a problem. Open dumping and unsanitary landfills are sometimes the main disposal methods, particularly in lower income cities; sanitary landfills are the norm in only a limited number of cities worldwide.

16.4.2 Supporting indicator requirements

The percentage of the city's solid waste that is disposed of in a sanitary landfill shall be calculated as the amount of the city's solid waste that is disposed of in a sanitary landfill in tonnes (numerator) divided by the total amount of solid waste produced in the city in tonnes (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

Sanitary landfill shall refer to a carefully designed structure which uses a clay liner or a synthetic liner in order to isolate solid waste from the surrounding environment. This isolation is accomplished with a bottom liner and daily covering of soil.

16.4.3 Data sources

This information should be obtained from municipal bodies, public services and major private contractors dealing with solid waste collection and disposal. Data may be obtained from specific studies carried out on solid waste for specific projects.

Information on selected disposal methods should be gathered from municipal facilities and operators, parastatal and private companies dealing with solid waste treatment. Solid waste experts, as well as NGOs working in this area, may be consulted.

When data are not available, an estimate of the proportion of waste to sanitary landfill and the proportion disposed to open dump should be provided.

16.5 Percentage of the city's solid waste that is disposed of in an incinerator (supporting indicator)

16.5.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE Many cities generate more solid waste than they can dispose of. Even when municipal budgets are adequate for collection, the safe disposal of collected waste often remains a problem. As sanitary landfill sites are limited, cities examine other alternatives for disposal such as incineration.

16.5.2 Supporting indicator requirements

The percentage of the city's solid waste that is disposed of in an incinerator shall be calculated as the total amount of the city's solid waste that is disposed of in an incinerator in tonnes (numerator) divided by the total amount of solid waste produced in the city in tonnes (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

An incinerator shall refer to a unit or facility used to burn waste, often referred to as an incineration plant.

16.5.3 Data sources

This information should be obtained from municipal bodies, public services and major private contractors dealing with solid waste collection and disposal. Data may be obtained from specific studies carried out on solid waste for specific projects.

Information on selected disposal methods should be gathered from municipal facilities and operators, parastatal and private companies dealing with solid waste treatment. Solid waste experts, as well as NGOs working in this area, may be consulted.

When data are not available, an estimate of the proportion of waste to sanitary landfill and the proportion disposed to open dump should be provided.

16.6 Percentage of the city's solid waste that is burned openly (supporting indicator)

16.6.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE Many cities generate more solid waste than they can dispose of. Even when municipal budgets are adequate for collection, the safe disposal of collected waste often remains a problem. Open burning as a disposal method remains an alternative for some cities facing budgetary limitations, particularly in lower income cities.

16.6.2 Supporting indicator requirements

The percentage of the city's solid waste that is burned openly shall be calculated as the amount of the city's solid waste that is burned in tonnes (numerator) divided by the total amount of solid waste produced in the city in tonnes (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

Burned openly shall refer to the combustion of solid waste in an open dump or open space.

16.6.3 Data sources

This information should be obtained from municipal bodies, public services and major private contractors dealing with solid waste collection and disposal. Data may be obtained from specific studies carried out on solid waste for specific projects.

Information on selected disposal methods should be gathered from municipal facilities and operators, parastatal and private companies dealing with solid waste treatment. Solid waste experts, as well as NGOs working in this area, may be consulted.

When data are not available, an estimate of the proportion of waste to sanitary landfill and the proportion disposed to open dump should be provided.

16.7 Percentage of the city's solid waste that is disposed of in an open dump (supporting indicator)

16.7.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE Many cities generate more solid waste than they can dispose of. Even when municipal budgets are adequate for collection, the safe disposal of collected waste often remains a problem. Open dump as a disposal method remains an alternative for some cities facing budgetary limitations, particularly in lower income cities.

16.7.2 Supporting indicator requirements

The percentage of the city's solid waste that is disposed of in an open dump shall be calculated as the amount of the city's solid waste that is disposed of in an open dump in tonnes (numerator) divided by the total amount of solid waste produced in the city in tonnes (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

Open dump shall refer to an uncovered space or hole where solid waste is disposed of without further treatment.

16.7.3 Data sources

This information should be obtained from municipal bodies, public services and major private contractors dealing with solid waste collection and disposal. Data may be obtained from specific studies carried out on solid waste for specific projects.

Information on selected disposal methods should be gathered from municipal facilities and operators, parastatal and private companies dealing with solid waste treatment. Solid waste experts, as well as NGOs working in this area, may be consulted.

When data are not available, an estimate of the proportion of waste to sanitary landfill and the proportion disposed to open dump shall be provided.

16.8 Percentage of the city's solid waste that is disposed of by other means (supporting indicator)

16.8.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE Many cities generate more solid waste than they can dispose of. Even when municipal budgets are adequate for collection, the safe disposal of collected waste often remains a problem.

16.8.2 Supporting indicator requirements

The percentage of the city's solid waste that is disposed of by other means shall be calculated as the total amount of the city's solid waste that is disposed of by other means in tonnes (numerator) divided by the total amount of solid waste produced in the city in tonnes (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

Other means shall refer to methods of disposal by means other than the ones indicated in 16.3 (recycling), 16.4 (sanitary landfill), 16.5 (incinerator), 16.6 (burned openly), and 16.7 (open dump).

16.8.3 Data sources

This information should be obtained from municipal bodies, public services and major private contractors dealing with solid waste collection and disposal. Data may be obtained from specific studies carried out on solid waste for specific projects.

Information on selected disposal methods should be gathered from municipal facilities and operators, parastatal and private companies dealing with solid waste treatment. Solid waste experts, as well as NGOs working in this area, may be consulted.

When data are not available, an estimate of the proportion of waste to sanitary landfill and the proportion disposed to open dump should be provided.

16.9 Hazardous Waste Generation per capita (tonnes) (supporting indicator)

16.9.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE The amount of hazardous waste generated is an indication of the risk to human health and the environment from hazardous substances. Hazardous waste impacts human health and degrades the environment. Hazardous waste may represent an immediate danger, such as burning skin on contact, or longer-term human health or environmental risks due to accumulation and persistence of toxics in the environment. Since many hazardous substances are persistent, breaking down very slowly in the environment, they build up in the air, water, food and soil. If disposed of without proper treatment, hazardous wastes can cause serious, long-lasting damage to both terrestrial and aquatic ecosystems. This may lead to habitat fragmentation and the disruption of ecosystem functioning, which in turn may lead to species loss and the decreased ability of ecosystems to support human livelihoods and commercial activities.

16.9.2 Supporting indicator requirements

The hazardous waste generation per capita shall be calculated as the annual total amount of hazardous waste in tonnes (numerator) divided by total city population (denominator). The result shall be expressed as total hazardous waste generated per capita in tonnes.

Hazardous waste generated in the city includes hazardous waste collected under national or municipal hazardous waste directives or regulations, and in accordance with the city's monitoring and information systems. Hazardous waste is usually accepted at landfills, hazardous waste treatment facilities (including incinerators) and wastewater treatment facilities located in the boundaries of the city. This indicator also covers those hazardous wastes exported for disposal.

NOTE Normally the industrial sector is the biggest producer of hazardous waste and they are responsible for adequate disposal and recycling of their waste. However, private households also produce hazardous waste which should be collected separately for adequate disposal and recycling. The Municipality should inform citizens on the negative impacts of this type of waste on the environment and encourage them to use the different collection methods (e.g. separate collection or dedicated collection points).

Hazardous waste shall refer to any substance intended for disposal, which can be harmful to people, plants, animals or the environment. A waste shall be defined as hazardous if it shows one or more of the following characteristics: toxicity, flammability, corrosivity or reactivity. They can be in any form - liquids, solids, gases (in containers), or sludge and are produced by manufacturing processes, the chemical industry, the petroleum industry and other industrial sectors. Examples include acids, alkalis, solvents, medical waste, resins, sludge and heavy metals.

Hazardous wastes are those substances that require special technologically advanced methods of disposal to render them harmless or less dangerous to humans and the environment. Hazardous waste must be treated, stored, and disposed of properly at designated sites. Most hazardous wastes are eventually disposed in landfills, surface impoundments (which eventually become landfills), land application units, or by deep well injection.

16.9.3 Data sources

Municipal hazardous waste landfill sites; provincial or state authorities that regulate the operations of local facilities; census data.

16.10 Percentage of the city's hazardous waste that is recycled (supporting indicator)

16.10.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE Hazardous waste impacts human health and degrades the environment. Hazardous waste reuse, recycling, and reclamation can:

— reduce risks to human health,

— avoid environmental hazards,

— conserve and protect scarce natural resources,

— provide economic benefits, and

— reduce reliance on raw materials and energy.

16.10.2 Supporting indicator requirement

The percentage of the city's hazardous waste that is recycled shall be calculated as the total amount of hazardous waste that is recycled in tonnes (numerator) divided by the total amount of hazardous waste that is generated in tonnes (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

Recycled hazardous waste (or hazardous recyclables) shall refer to hazardous waste that is used, reused, or reclaimed.

16.10.3 Data sources

Municipal hazardous waste landfill sites; provincial or state authorities that regulate the operations of local facilities; census data

17 Telecommunication and innovation

17.1 Number of internet connections per 100 000 population (core indicator)

17.1.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE The number of internet connections is an indicator of information access and communication technology connectivity.

17.1.2 Core indicator requirements

The number of internet connections per 100 000 population shall be calculated as the number of internet connections in the city (numerator) divided by one 100 000th of the city's total population (denominator). The result shall be expressed as the number of internet connections per 100 000 population.

17.1.3 Data sources

Internet access records are kept by internet service and telecommunications providers in the form of subscriber locations and accounts. Other sources include government censuses, telecommunications records and official estimates.

17.2 Number of cell phone connections per 100 000 population (core indicator)

17.2.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE The number of cell phone connections in a city's population can reflect levels of telecommunication technology, information and communication technology, and innovation. Connectivity within a city, across regions and globally is a significant contributor to economic growth and development. This is also included under the Millennium Development Goals.[22]

17.2.2 Core indicator requirements

The number of cell phone connections per 100 000 shall be calculated as the total number of cell phone connections in the city (numerator) divided by one 100 000th of the city's total population (denominator). The result shall be expressed as the number of cell phone connections per 100 000 population.

Individuals may have more than one cell phone connection which shall be counted.

17.2.3 Data sources

Cell phone service records are kept by telecommunications providers in the form of subscriber locations and accounts. Other sources include government censuses, telecommunications records and official estimates.

17.3 Number of landline phone connections per 100 000 population (supporting indicator)

17.3.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE The number of telephone connections is an indicator of information and communication technology and connectivity. Connectivity within a city, across regions and globally is a significant contributor to economic growth and development.

17.3.2 Supporting indicator requirements

The number of landline phone connections per 100 000 shall be calculated as the total number of landline telephone connections in the city (numerator) divided by one 100 000th of the city's total population (denominator). This result shall be expressed as the number of landline connections per 100 000 population.

The total number of the city's landline telephone connections shall not include cellular connections and shall be reported separately.

The total number of telephone connections shall include domestic, business and other organizations.

17.3.3 Data sources

Telephone service records are kept by telecommunications providers in the form of subscriber locations and accounts. Other sources include government censuses, telecommunications records and official estimates.

18 Transportation

18.1 Kilometres of high capacity public transport system per 100 000 population (core indicator)

18.1.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE The extent of a city's transportation network can provide insight into traffic congestion, transportation system flexibility, and urban form. Cities with larger amounts of public transport may tend to be more geographically compact and supportive of non-motorized modes of transportation.

18.1.2 Core indicator requirements

The kilometres of high capacity public transport system per 100 000 population shall be calculated by adding the kilometres of high capacity public transport systems operating within the city (numerator) divided by one 100 000th of the city's total population (denominator). The result shall be expressed as the kilometres of high capacity public transport system per 100 000 population.

High capacity public transport may include heavy rail metro, subway systems and commuter rail systems.

18.1.3 Data sources

Information on kilometres of high capacity public transport should be gathered from municipal transport offices and local/regional transit authorities and can also be counted using computerized mapping, aerial photography, or existing paper maps, all of which shall be field-verified. This information may be gathered from transport system plans or other master plans.

18.2 Kilometres of light passenger public transport system per 100 000 population (core indicator)

18.2.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE The extent of a city's transportation network can provide insight into traffic congestion, transportation system flexibility, and urban form. Cities with larger amounts of public transport may tend to be more geographically compact and supportive of non-motorized modes of transportation.

18.2.2 Core indicator requirements

The kilometres of light passenger public transport system per 100 000 population shall be calculated by adding the kilometres of light passenger transport systems provided within the city (numerator), divided by one 100 000th of the city's total population (denominator). The result shall be expressed as the kilometres of light passenger transport system per 100 000 population. Expressed as per 100 000 population.

Light passenger transport may include light rail streetcars and tramways, bus, trolleybus and other light passenger transport services.

18.2.3 Data sources

Information on kilometres of light passenger transport should be gathered from municipal transport offices and local/regional transit authorities and can also be counted using computerized mapping, aerial photography, or existing paper

maps, all of which shall be field-verified. This information may be gathered from transport system plans or other master plans.

18.3 Annual number of public transport trips per capita (core indicator)

18.3.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE Transport usage is a key indicator of how easy it is to travel in the city by modes other than single occupancy vehicles. The indicator might also provide insight into transportation policy, traffic congestion, and urban form. Cities with higher transport ridership rates tend to invest more in their transport systems and are more geographically compact. Transport usage also addresses overall travel patterns in the city, and not just the journey to work.

18.3.2 Core indicator requirements

Annual number of public transport trips per capita shall be calculated as the total annual number of transport trips originating in the city - "ridership of public transport" - (numerator), divided by the total city population (denominator). The result shall be expressed as the annual number of public transport trips per capita.

Transport trips shall include trips via heavy rail metro or subway, commuter rail, light rail streetcars and tramways, organized bus, trolleybus, and other public transport services.

Cities shall only calculate the number of transport trips with origins in the city itself.

NOTE Transport systems often serve entire metropolitan areas, and not just central cities. The use of number of transport trips with origins in the city itself will still capture many trips whose destination are outside the city, but will generally capture the impact that the city has on the regional transport network.

18.3.3 Data sources

Transport data should be gathered from a number of sources, including: official transport surveys, revenue collection systems (e.g. number of fares purchased), and national censuses.

NOTE 1 Farebox records (e.g. transport fares paid) are usually the primary source of data for this indicator. However, the relationship between fares purchased and trips taken is not always exact. For example, many transport systems do not actively check for proof of fare purchase – often, riders are expected to have valid tickets, and are severely fined if a ticket is not presented, but enforcement of such rules is not uniform for every rider on every trip. Other transport systems offer monthly or weekly passes, which do not necessarily allow for accurate counts of each trip.

NOTE 2 In many countries, a large number of trips are made via "informal transport" services (e.g. mini-buses not operated by the government or municipal transport corporation). These informal trips are not part of the official transport network and shall not be counted.

NOTE 3 While higher transport ridership rates are generally considered desirable, extremely high ridership rates can also indicate cities with overcrowding problems.

18.4 Number of personal automobiles per capita (core indicator)

18.4.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE Measuring each type of transportation infrastructure sheds light on travel behaviour. The use of automobiles as a travel mode provides access to work, shopping, school and other community services. This measure can also inform the need for further transport facilities.

18.4.2 Core indicator requirements

The number of personal automobiles per capita shall be calculated as the total number of registered personal automobiles in a city (numerator) divided by the total city population (denominator). The result shall be expressed as the number of personal automobiles per capita.

The total number of registered personal automobiles shall include automobiles used for personal use by commercial enterprises.

This number shall not include automobiles, trucks and vans that are used for the delivery of goods and services by commercial enterprises.

18.5 Percentage of commuters using a travel mode to work other than a personal vehicle (supporting indicator)

18.5.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE The mode of transportation used to commute to work is a key indicator of transportation policy, traffic congestion, urban form, and energy use. Cities with lower personal vehicle usage tend to be more supportive of public transit, and are more geographically compact. Lower use of single occupancy vehicles (SOV) is increasingly correlated with lower energy consumption and lower emissions of smog-producing chemicals.

18.5.1.1 Supporting indicator requirements

Percent of commuters using a travel mode to work other than a personal vehicle shall be calculated as the number of commuters working in the city who use a mode of transportation other than a private Single Occupancy Vehicle (SOV) as their primary way to travel to work (numerator) divided by all trips to work, regardless of mode (denominator). The result shall then be multiplied by 100 and expressed as a percentage of commuters using a travel mode other than a personal vehicle.

Modes other than non-SOV may include carpools, bus, mini-bus, train, tram, light rail, ferry, motorcycle and non-motorized two-wheel vehicles such as bicycles, and walking, and other modes.

NOTE This indicator uses commuters who work in the subject city, regardless of where they live. Even if these individuals do not live in the subject city, they use the transportation resources of the city, and therefore create impacts on the city's entire transportation system.

For cases where multiple modes are used, the indicator shall reflect the primary travel mode, either by length of trip on that mode or by distance travelled on that mode. For example, if a person drives a SOV from home to a suburban train station (5 minutes), takes a 30-minute train ride to the central city, and then takes a 5- minute bus ride to their office, the primary travel mode is the passenger train.

18.5.2 Data sources

The most likely sources of data for this indicator are travel surveys that collect trip frequency, trip duration, and travel mode information from a statistically significant sample of a city's population. Such surveys are frequently performed at irregular intervals (primarily due to the cost and time associated with such an undertaking).

One common form of survey is a written travel log. Individuals or families use a log book or notebook to record information such as travel mode, time, distance, and length of each trip.

This information is also frequently collected in general population censuses, which occur at regular intervals.

18.6 Number of two-wheel motorized vehicles per capita (supporting indicator)

18.6.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE This indicator is important to cities that use two-wheel motorized vehicles such as motorcycles and scooters as a major mode of transport. An indicator of non motorized two-wheel vehicles such as bicycles is also an important measure for sustainable city mobility and is reported as separate indicator.

18.6.2 Supporting indicator requirements

The number of two-wheel motorized vehicles per capita shall be calculated as the total number of two-wheel motorized vehicles in the city (numerator) divided by the total city population (denominator). The result shall be expressed as the number of two-wheel motorized vehicles per capita.

Two-wheel motorized vehicles shall include scooters and motorcycles. This shall not include non motorized vehicles such as bicycles.

18.7 Kilometres of bicycle paths and lanes per 100 000 population (supporting indicator)

18.7.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE A transportation system that is conducive to bicycling can reap many benefits in terms of reduced traffic congestion and improved quality of life. Economic rewards both to the individual and to society are also realized through reduced health care costs and reduced dependency on auto ownership (and the resulting in insurance, maintenance and fuel costs). Bicycle lanes also require smaller infrastructure investments than other types of transportation infrastructure. Cycling has less of an environmental impact. This indicator provides city's with a useful measure of a diversified transportation system.

18.7.2 Supporting indicator requirements

Kilometres of bicycle paths and lanes per 100 000 population shall be calculated as the total kilometres of bicycle paths and lanes (numerator) divided by one 100 000th of the city's total population (denominator). The result shall be expressed as the kilometres of bicycle paths and lanes per 100 000 population.

Bicycle lanes shall refer to part of a carriageway designated for cycles and distinguished from the rest of the road/carriageway by longitudinal road markings.

Bicycle paths shall refer to independent road or part of a road designated for cycles and sign-posted as such. A cycle track is separated from other roads or other parts of the same road by structural means.

18.8 Transportation fatalities per 100 000 population (supporting indicator)

18.8.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE Traffic accident rates and, specifically, fatality rates, can serve as indicators for the overall safety of the transportation system, the complexity and congestion of the roadway and transport network, the amount and effectiveness of traffic law enforcement, the quality of the transportation fleet (public and private), and the condition of the roads themselves. Traffic deaths represent the most severe type of traffic safety failure, allowing cities to focus on their most urgent traffic safety needs.

18.8.2 Supporting indicator requirements

Transportation fatalities per 100 000 population shall be calculated as the number of fatalities related to transportation of any kind within the city borders (numerator), divided by one 100 000th of the city's total population (denominator). The result shall be expressed as the number of transportation fatalities per 100 000 population.

The city shall include in this indicator deaths due to any transportation-related proximate causes in any mode of travel (automobile, public transport, walking, bicycling, etc.). The city shall count any death directly related to a transportation incident within city limits, even if death does not occur at the site of the incident, but is directly attributable to the accident.

NOTE Transportation fatalities are used here as a proxy for all transportation injuries. Whereas many minor injuries are never reported—and thus cannot be measured— deaths are almost always reported. It is also worth noting that differences in the quality of the roadway, the quality of motorized vehicles, and the nature of law enforcement can change the relationship between injury and fatality. Cities and countries may have different definitions of causality, specifically related to the amount of time that can elapse between a traffic incident and a death.

18.9 Commercial air connectivity (number of non-stop commercial air destinations) (supporting indicator)

18.9.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE The diversity of non-stop commercial airline destinations is indicative of a city's connectivity to the rest of the nation and the world. Cities with high commercial air connectivity typically have more robust economies and are able to provide a higher level of service to residents. Although commercial air is one demonstration of connectivity, other modes such as rail can also measure connectivity and may be considered a more sustainable alternative to air travel.

18.9.2 Supporting indicator requirements

Commercial air connectivity shall be expressed as the sum of all non-stop commercial (i.e. scheduled) flights departing from all airports serving the city.

Airports serving the city shall include all airports within a two hour travel distance from the subject city.

EXAMPLE Paris could count flights departing from Charles de Gaulle and Orly airports.

Connecting flights shall be excluded because travel is theoretically possible between any two cities in the world, given an unlimited number of connections.

18.9.3 Data sources

Commercial air destinations lists should be obtained from airport operators, passenger airport facility planners, and/or federal aviation agencies. Web resources including airline websites and the Official Airline Guide (OAG) may also be used.

19 Urban planning

19.1 Green area (hectares) per 100 000 population (core indicator)

19.1.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE The amount of green area, natural and semi-natural, parks and other open space is an indicator of how much green space a city has. Green areas perform important environmental functions in an urban setting. They improve the urban climate, capture atmospheric pollutants and improve quality of life by providing recreation for urban inhabitants.

19.1.2 Core indicator requirements

Green area (hectares) per 100 000 population shall be calculated as the total area (in hectares) of green in the city (numerator) divided by one 100 000th of the city's total population (denominator). The result shall be expressed in hectares of green area per 100 000 population.

This indicator reflects green area that is "publicly accessible" as opposed to whether or not the green area is protected.

NOTE Green area is broader than recreation space (See Clause 13).

19.1.3 Data sources

Information on green area should be obtained from municipal recreation and parks departments, planning departments, forestry departments and census.

19.2 Annual number of trees planted per 100 000 population (supporting indicator)

19.2.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE The annual number of trees planted per 100 000 population is a useful measure of a city's commitment to urban and environmental sustainability, as well as municipal beautification. Trees, in an urban context, are often cited as an important tool in reducing the impacts of climate change due to their role in removing carbon dioxide from the Earth's atmosphere.

19.2.2 Supporting indicator requirement

The annual number of trees planted per 100 000 shall be calculated as the total number of trees planted in a given year (numerator) divided by one 100 000th of the city's total population (denominator). The result shall be expressed as the annual number of trees planted per 100 000 population.

The number of trees planted shall include trees planted and/or funded by government (or by a third party under government oversight). This shall include trees planted by private businesses and non-governmental organizations under the purview of government greening and reforestation initiatives.

19.2.3 Data sources

Numbers and figures shall be based on plantings and expenditures of municipal government record and not general estimates. Information can be obtained from municipal government records, census, municipal departments of forestry and other related planning or environmental departments of the city.

19.2.4 Data interpretation

A city's tree planting strategy should reflect not only the number of new trees planted but also attention to indigenous species.

19.3 Areal size of informal settlements as a percentage of city area (supporting indicator)

19.3.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE Settlements characterized by irregular tenure, unplanned development and unauthorized shelter that is not in compliance with local building codes and regulations, are generally marginal and precarious, and affect social well-being, human health and economic development. The size of informal settlements is an indicator of the extent of the challenges for the reporting city in meeting shelter needs and demand.

19.3.2 Supporting indicator requirements

The areal size of informal settlements as a percentage of city area shall be calculated as the area of informal settlements in square kilometres (numerator) divided by the city area in square kilometres (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

To simplify the measure of informal settlements, those smaller than 2 km^2 should not be included.

Informal settlements are known by many different names around the world including shantytowns, favelas (Brazil), squatter camps (South Africa), and

bidonvilles in French-speaking areas. The UN Statistics Division has developed the following definition which is used here:

a) Areas where groups of housing units have been constructed on land that the occupants have no formal legal claim to;

b) Unplanned settlements and areas where housing is not in compliance with current planning and building regulations (unauthorized housing).[17]

NOTE While many informal settlements also meet the definition of slum, the terms are not synonymous. Slums may exist in areas that do not meet the definition of informal settlements. Some informal settlements may have improved such that they do not meet the definition of slum.

19.3.3 Data sources

Data should be gathered from the City Planning Department together with departments knowledgeable about the city neighbourhoods. Local academic institutions may also be of assistance. Areas of informal settlements should be delineated using aerial photography and/or land use maps and the area in square kilometres shall be calculated. Some low cost and more sophisticated measurement methodologies have been developed. Once the areas have been identified on a map, the area in square kilometres should be calculated using low cost GIS or, if not available, hand-held measuring devices may be used.

19.4 Jobs/housing ratio (supporting indicator)

19.4.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE A well-planned city focuses on the implications of new growth on its economy, existing communities and the environment. Growth should be concentrated in areas that can accommodate a mix of housing, commerce, industry and recreation to maximize the use of existing infrastructure, minimize travel times to and from work, and minimize servicing costs resulting from new growth. Encouraging mixed-use developments combining housing and employment opportunities is essential to achieve these objectives.

19.4.2 Supporting indicator requirements

The jobs/housing ratio shall be calculated as the total number of jobs (numerator) divided by the total number of dwelling units (denominator). The result shall be expressed as a whole number reflecting jobs to housing ratio within a city.

Jobs shall refer to all types of employment opportunities including those provided in the retail, industrial, government and office sectors located within the city boundaries. Housing shall refer to all dwelling units available for habitation.

This indicator does not take into account the informal sector, labour or employment, as unofficial employment is unaccounted for.

20 Wastewater

20.1 Percentage of city population served by wastewater collection (core indicator)

20.1.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE The percentage of the city population served by a wastewater collection is an indicator of city health, cleanliness and quality of life. Wastewater collection and treatment is a significant component of the Millennium Development Goals.[22]

20.1.2 Core indicator requirements

Percentage of city population served by wastewater collection shall be calculated as the number of people within the city that are served by wastewater collection (numerator) divided by the city population (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

The number of households in the city serviced with regular wastewater collection shall first be determined by counting the number of households that are connected as part of a public or community owned system of discharge of served waters and other residues through a pipe or similar duct that is connected to a network that takes it to a facility where it is treated. The number of households being serviced by wastewater connection shall then be multiplied by the then current average household size for that city to determine the number of persons serviced with wastewater collection.

NOTE Results will only indicate whether or not a house has access to wastewater systems, not the quality of the system, the capacity and quality of the service, the levels of loss (contamination), or the capacity of the treatment plants to meet the growth in waste water volumes. Some of these limitations will be addressed in other supporting indicators.

20.1.3 Data sources

Information on the number of households in the city serviced with regular wastewater collection should be obtained from the local operator(s) of wastewater systems.

20.2 Percentage of the city's wastewater that has received no treatment (core indicator)

20.2.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE It has been proven that improvement of water treatment reduces the incidence of a variety of water-borne diseases. A reliable wastewater treatment system is a major indicator of the level of local development and of community health. Water pollution from human waste is less of a problem in countries that can afford to treat sewage and wastewater, and water pollution can be minimized with adequate investment in treatment systems. The percentage of wastewater treated is a key indicator of water quality management.

20.2.2 Core indicator requirements

Percentage of the city's wastewater that has received no treatment shall be calculated as the total amount of the city's wastewater that has undergone no treatment (numerator) divided by the total amount of wastewater produced in the city and collected (denominator). This result shall then be multiplied by 100 and expressed as a percentage.

No treatment shall refer to collected wastewater that is discharged to a water body without any treatment, including periods when wastewater volume exceeds treatment plant capacity.

20.2.3 Data sources

This information may be obtained by municipal authorities and the main water supply and treatment companies.

20.3 Percentage of the city's wastewater receiving primary treatment (core indicator)

20.3.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE The percentage of wastewater treated is a key indicator of water quality management. It has been proven that improvement of water treatment reduces the incidence of a variety of water-borne diseases. A reliable wastewater treatment system is a major indicator of the level of local development and of community health. Water pollution from human waste is less of a problem in countries that can afford to treat sewage and wastewater, and water pollution can be minimized with adequate investment in treatment systems.

20.3.2 Core indicator requirements

The percentage of the city's wastewater receiving primary treatment shall be calculated as the total amount of the city's wastewater that has undergone primary treatment (numerator) divided by the total amount of wastewater produced in the city and collected (denominator). This result is then multiplied by 100 and expressed as a percentage of the city's wastewater receiving primary treatment.

Primary wastewater treatment shall refer to the physical separation of suspended solids from the wastewater flow using primary clarifiers. This separation reduces total suspended solids as well as the biological oxygen demand (BOD) levels and prepares the waste stream for the next step in the wastewater treatment process.

NOTE Biological Oxygen Demand (BOD) is the amount of dissolved oxygen required to oxidize or neutralize biodegradable matter in water. High BOD levels represent high amounts of contaminant matter, and the reduction of BOD is a common measure for determining the efficacy of water treatment.

Some cities have no system for treating wastewater. This shall be reported.

20.3.3 Data sources

This information may be obtained from municipal authorities and the main water supply and treatment companies.

20.4 Percentage of the city's wastewater receiving secondary treatment (core indicator)

20.4.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE It has been proven that improvement of water treatment reduces the incidence of a variety of water-borne diseases. A reliable wastewater treatment system is a major indicator of the level of local development and of community health. Water pollution from human waste is less of a problem in countries that can afford to treat sewage and wastewater, and water pollution can be minimized with adequate investment in treatment systems. The percentage of wastewater treated is a key indicator of water quality management.

20.4.2 Core indicator requirements

Percentage of the city's wastewater receiving secondary treatment shall be calculated as the total amount of the city's wastewater that has undergone secondary treatment (numerator) divided by the total amount of wastewater produced in the city and collected (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

Secondary treatment shall refer to the process of removing or reducing contaminants or growths that are left in the wastewater from the primary treatment process. Secondary treatment reduces Biological Oxygen Demand (BOD) by microbial oxidation.

NOTE BOD is the amount of dissolved oxygen required to oxidize or neutralize biodegradable matter in water. High BOD levels represent high amounts of contaminant matter, and the reduction of BOD is a common measure for determining the efficacy of water treatment.

Some cities have no system for treating wastewater. This shall be reported.

20.4.3 Data sources

This information may be obtained from municipal authorities and the main water supply and treatment companies.

20.5 Percentage of the city's wastewater receiving tertiary treatment (core indicator)

20.5.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE It has been proven that improvement of water treatment reduces the incidence of a variety of water-borne diseases. A reliable wastewater treatment system is a major indicator of the level of local development and of community health. Water pollution from human waste is less of a problem in countries that can afford to treat sewage and wastewater, and water pollution can be minimized with adequate investment in treatment systems. The percentage of wastewater treated is a key indicator of water quality management.

20.5.2 Core indicator requirements

Percentage of the city's wastewater receiving tertiary treatment shall be calculated as the total amount of the city's wastewater that has undergone tertiary treatment (numerator) divided by the total amount of wastewater produced in the city and collected (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

Tertiary treatment shall refer to the next wastewater treatment process after secondary treatment. This step removes stubborn contaminants that secondary treatment was not able to clean up. Wastewater effluent becomes even cleaner in this treatment process through the use of stronger and more advanced treatment systems. Tertiary treatment technologies can be extensions of conventional secondary biological treatment to reduce Biological Oxygen Demand (BOD) levels and further stabilize oxygen-demanding substances in the wastewater and to remove nitrogen and phosphorus. Tertiary treatment may also involve physical-chemical separation techniques such as carbon adsorption,

flocculation/precipitation, membranes for advanced filtration, ion exchange, chlorination, dechlorination and reverse osmosis.

NOTE BOD is the amount of dissolved oxygen required to oxidize or neutralize biodegradable matter in water. High BOD levels represent high amounts of contaminant matter, and the reduction of BOD is a common measure for determining the efficacy of water treatment.

Some cities have no system for treating wastewater. This shall be reported.

20.5.3 Data sources

This information may be obtained from municipal authorities and the main water supply and treatment companies.

21 Water and sanitation

21.1 Percentage of city population with potable water supply service (core indicator)

21.1.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE The percentage of the city population served by a potable water supply is an indicator of city health and quality of life and a significant component of the Millennium Development Goals.[22]

21.1.2 Core indicator requirements

The percentage of city population with potable water supply service shall be calculated as the total number of people with potable water supply service (numerator) divided by total city population (denominator). The result shall then be multiplied by 100 and expressed as a percentage of city population serviced by a potable water supply service.

The total number of people with potable water supply service shall be calculated as the total number of households in the city connected to a potable water supply service multiplied by the current average household size for the city.

NOTE 1 Results will only indicate whether or not a house has access to potable water, not the quality of the delivery, the levels of loss, consumption or misuse, or the capacity of the sources to meet the demand.

Potable water shall refer to water that is treated or confirmed safe for human consumption. A potable water supply service shall refer to a service that delivers potable water through a pipe or similar duct that is connected to a network, the supply of which is relatively continuous given that it includes a deposit built for its storage. If a house or group of houses has a ‘mother’ pipe connected either

provisionally or permanently; it shall be considered to have access to potable water.

A house shall not be considered to have access to potable water when an individual house or group is served by a conduit system built with for example wood, bamboo, or rubber hose, connected directly to a river, well, or to another house.

21.1.3 Data sources

Information should be obtained from the local operator(s) of water supply systems.

21.2 Percentage of city population with sustainable access to an improved water source (core indicator)

21.2.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE Access to drinking water is a fundamental need and a human right vital for the health of all people. About 1.1 billion people have no access to any type of improved drinking source of water. 1.6 million people die every year from diarrhoeal diseases attributable to lack of safe drinking water and basic sanitation. The health and economic benefits of improved water supply to households and individuals are well documented.[12]

21.2.2 Core indicator requirements

The percentage of city population with sustainable access to an improved water source shall be calculated as the total population with access to an improved water source (numerator) divided by the total city population. The result shall then be multiplied by 100 and expressed as a percentage.

An improved water source shall refer to piped water, public tap, borehole or pump, protected well, protected spring or rainwater.

The percentage of city population with sustainable access to an improved water source represents the percentage of the population with reasonable access to an adequate supply of safe water in their dwelling or within a convenient distance of their dwelling. Reasonable access to water is defined as the availability of at least 20 litres of water per person a day from a source within one kilometer of the dwelling.

21.3 Percentage of population with access to improved sanitation (core indicator)

21.3.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

NOTE Access to improved sanitation is fundamental need vital for the dignity and health of all people. About 2.6 billion people lack even a simple 'improved' latrine. Furthermore, 1.6 million people die every year from diarrhoeal diseases attributable to lack of safe drinking water and basic sanitation.

21.3.2 Core indicator requirements

The percentage of population with access to improved sanitation shall be calculated as the total number of people using improved sanitation facilities (numerator) divided by the total city population (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

Access to improved sanitation facilities shall refer to the percentage of the city population with at least adequate access to excreta disposal facilities that can effectively prevent human, animal and insect contact with excreta. Improved facilities range from simple, but protected pit latrines to flush toilets with a sewerage connection. To be effective, facilities must be correctly constructed and properly maintained.

Improved sanitation facilities shall include:

— Flush or pour-flush to piped sewer system, septic tank or pit latrine,

— Ventilated improved pit latrine,

— Pit latrine with slab and

— Composting toilet

NOTE Sanitation facilities are not considered improved when shared with other households, or open to public use.

Unimproved sanitation shall include:

— Flush or pour-flush to elsewhere,

— Pit latrine without slab or open pit,

— Bucket, hanging toilet or hanging latrine and

— No facilities or bush or field (open defecation)

21.4 Total domestic water consumption per capita (litres/day) (core indicator)

21.4.1 General

Those implementing this International Standard shall report on this indicator in accordance with the following requirements.

Water consumption must be in harmony with water resources to be sustainable. This harmony may be achieved through improvements in water supply systems and changes in water consumption patterns. This indicator will need to be measured in terms of changes from year to year within a city within a range of rates due to the variability among cities. Consumption of water per person depends on the availability and price of water, the climate, and the uses to which water is customarily put by individuals (drinking, bathing, washing, gardening). In many cities, potable water supply is not constant and households rely on a few hours to tap the available water during the day. Water consumption is usually much higher in cities of higher income countries.

21.4.2 Core indicator requirements

The total domestic water consumption per capita shall be calculated as the total amount of the city's water consumption in litres per day for domestic use (numerator) divided by the total city population (denominator). The result shall be expressed as the total domestic water consumption per capita in litres per day.

Only water consumed for domestic purpose shall be taken into account. Water consumed for industrial and commercial purposes shall be excluded.

NOTE Domestic water use is a small portion of total water consumption (e.g. 10 per cent in the European Union), trailing agricultural and industrial uses. Before reaching the users, a part of the water supplied might be lost through leakage or illegal tapping. In cities with old and deteriorating water reticulation systems, a substantial proportion of piped water may be lost through cracks and flaws in pipes – for example up to 30 per cent of water is lost in this way in some countries in Eastern Europe. It is therefore important to take this into account in the final consumption measure and if possible, not to take the actual supply as the final consumption figure.

21.4.3 Data sources

This information should be obtained from the main water supply companies, which maintain records on water supplied, delivered, consumed and ultimately paid by the end-users for domestic purposes.

21.4.4 Data interpretation

In interpreting this indicator, water consumption per capita should fall within a range that is sustainable for the climate of the city. A minimum benchmark should be established to meet public health and safety needs. Higher rates of per

capita water consumption should show reductions approaching the minimum or sustainable consumption rates.

NOTE Water consumption rates may temporarily spike with income as new appliances are purchased and until water prices increase, encouraging water saving appliances to enter the market.

21.5 Total water consumption per capita (litres/day) (supporting indicator)

21.5.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

Water consumption must be in harmony with water resources to be sustainable. This harmony may be achieved through improvements in water supply systems and changes in water consumption patterns. This indicator will need to be measured in terms of changes from year to year within a city within a range of rates due to the variability among cities. Consumption of water per person depends on the availability and price of water, the climate, and the uses to which water is customarily put by individuals (drinking, bathing, washing, gardening) and industrial, commercial and agricultural entities. In many cities, potable water supply is not constant and households rely on a few hours to tap the available water during the day. Water consumption is much higher in cities of higher income countries, as with most other forms of consumption.

21.5.2 Supporting indicator requirements

Total water consumption per capita (litres/day) shall be calculated as the total amount of the city's water consumption in litres per day (numerator) divided by the total city population (denominator). The result shall be expressed as the total water consumption per capita in litres/days.

21.5.3 Data sources

This information should be obtained from the main water supply companies, which maintain record on water supplied, delivered, consumed and ultimately paid by the end-users.

21.6 Average annual hours of water service interruption per household (supporting indicator)

21.6.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE The reliability of water service to the user is the ultimate consideration in evaluating water supply, even though this reliability is based on both quantity and quality considerations and on interconnected systems of source water availability, water treatment and water distribution. This indicator determines whether a water supply system is reliable, or whether the water supply system needs fundamental or marginal improvements.

21.6.2 Supporting indicator requirements

The average annual hours of water service interruption per household shall be calculated by taking the total sum of hours of interruption multiplied by the number of households impacted (numerator), divided by the number of households (denominator). The result shall be expressed as the average annual hours of water service interruption per household.

Incidents of complete shutoff, low flow restriction, boil water advisory, water main flushing, planned and unplanned interruptions shall be counted equally.

This indicator shall exclude:

— incidents where there is some reduction to the level of service but where normal activities (shower, washing machine, toilet flushing etc.) are still possible, and

— breaks in house connection branches.

An “unplanned interruption” is an interruption caused by a fault in the utility’s system. A “planned interruption” is an interruption for which the utility has provided at least 24 h advanced notification (or as otherwise prescribed by regulatory requirements).

21.6.3 Data interpretation

Cities with older infrastructure, in areas with electric power interruptions, in areas of war or civil unrest, or in areas that are more susceptible to natural hazards such as earthquakes and extensive flooding will tend to report more incidents of service interruptions.

A physically larger service area is likely to have more kilometres of pipes and mains in the distribution system vulnerable to service interruptions. This indicator may need to be compared differently among large (greater than 25 000 connections or bulk water providers), medium (1 000 to 25 000 connections) and small (1 000 or fewer connections) service providers. To facilitate

comparison among cities, the number of interruptions can also be related to the hectares of water service area within the city.

21.7 Percentage of water loss (unaccounted for water) (supporting indicator)

21.7.1 General

Those implementing this International Standard should report on this indicator in accordance with the following requirements.

NOTE Before reaching the users, a part of the water supplied might be lost through leakage or illegal tapping. In cities with old and deteriorating water reticulation systems, a substantial proportion of piped water may be lost through cracks and flaws in pipes – for example up to 30 per cent of water is lost in this way in some countries in Eastern Europe.

21.7.2 Supporting indicator requirements

The percentage of water loss (unaccounted for water) shall be calculated as the volume of water supplied minus the volume of utilized water (numerator) divided by the total volume of water supplied (denominator). The result shall then be multiplied by 100 and expressed as a percentage.

The percentage of water loss (unaccounted for water) represents the percentage of water that is lost from treated water entering distribution system and that is accounted for and billed by the water provider. This includes actual water losses, e.g. leaking pipes, and billing losses, e.g. delivered through informal or illegal connection.

21.7.3 Data sources

Data should be obtained from water utilities servicing the city.

22 Reporting and record maintenance

Reports on city indicators shall compile the data required in the individual test methods used.

Annex A
(informative)

City indicators

Table A.1 — City services and quality of life indicators

	Core indicator	Supporting indicator
Economy (Clause 5)	City's unemployment rate	Percentage of persons in full-time employment
	Assessed value of commercial and industrial properties as a percentage of total assessed value of all properties	Youth unemployment rate
	Percentage of city population living in poverty	Number of businesses per 100 000 population
		Number of new patents per 100 000 population per year
Education (Clause 6)	Percentage of female school-aged population enrolled in school	Percentage of male school-aged population enrolled in school
	Percentage of students completing primary education	Percentage of school-aged population enrolled in school
	Percentage of students completing secondary education	Number of higher education degrees per 100 000 population
	Primary education student/ teacher ratio	

Table A.1 *(continued)*

	Core indicator	Supporting indicator
Energy (Clause 7)	Total residential electrical energy use per capita (kWh/year)	Total electrical energy use per capita (kWh/year)
	Percentage of city population with authorized electrical service	Average number of electrical interruptions per customer per year
	Energy consumption of public buildings per year (kWh/m^2)	Average length of electrical interruptions (in hours)
	Percentage of total energy derived from renewable sources, as a share of the city's total energy consumption	
Environment (Clause 8)	Fine Particulate Matter (PM2.5) concentration	NO^2 (nitrogen dioxide) concentration
	Particulate Matter (PM10) concentration	SO^2 (sulphur dioxide) concentration
	Greenhouse gas emissions measured in tonnes per capita	O_3 (ozone) concentration
		Noise pollution
		Percentage change in number of native species
Finance (Clause 9)	Debt service ratio (debt service expenditure as a percentage of a municipality's own-source revenue)	Capital spending as a percentage of total expenditures
		Own-source revenue as a percentage of total revenues
		Tax collected as percentage of tax billed

Table A.1 *(continued)*

	Core indicator	Supporting indicator
Fire and emergency response (Clause 10)	Number of firefighters per 100 000 population Number of fire related deaths per 100 000 population Number of natural disaster related deaths per 100 000 population	Number of volunteer and part-time firefighters per 100 000 population. Response time for emergency response services from initial call Response time for fire department from initial call
Governance (Clause 11)	Voter participation in last municipal election (as a percentage of eligible voters) Women as a percentage of total elected to city-level office	Percentage of women employed in the city government workforce Number of convictions for corruption and or bribery by city officials per 100 000 population Citizens' representation: number of local officials elected to office per 100 000 population Number of registered voters as a percentage of the voting age population
Health (Clause 12)	Average life expectancy Number of in-patient hospital beds per 100 000 population Number of physicians per 100 000 population Under age five mortality per 1 000 live births	Number of nursing and midwifery personnel per 100 000 population Number of mental health practitioners per 100 000 population Suicide rate per 100 000 population
Recreation (Clause 13)		Square metres of public indoor recreation space per capita Square metres of public outdoor recreation space per capita

Table A.1 *(continued)*

	Core indicator	Supporting indicator
Safety (Clause 14)	Number of police officers per 100 000 population	Crimes against property per 100 000
	Number of homicides per 100 000 population	Response time for police department from initial call
		Violent crime rate per 100 000 population
Shelter (Clause 15)	Percentage of city population living in slums	Number of homeless per 100 000 population
		Percentage of households that exist without registered legal titles
Solid waste (Clause 16)	Percentage of city population with regular solid waste collection (residential)	Percentage of the city's solid waste that is disposed of in a sanitary landfill
	Total collected municipal solid waste per capita	Percentage of the city's solid waste that is disposed of in an incinerator
	Percentage of the city's solid waste that is recycled	Percentage of the city's solid waste that is burned openly
		Percentage of the city's solid waste that is disposed of in an open dump
		Percentage of the city's solid waste that is disposed of by other means
		Hazardous waste generation per capita
		Percentage of city's hazardous waste that is recycled

Table A.1 *(continued)*

	Core indicator	Supporting indicator
Telecommunication and innovation (Clause 17)	Number of internet connections per 100 000 population Number of cell phone connections per 100 000 population	Number of landline phone connections per 100 000 population
Transportation (Clause 18)	Kilometres of high capacity public transport system per 100 000 population Kilometres of light passenger public transport system per 100 000 population Annual number of public transport trips per capita Number of personal automobiles per capita	Percentage of commuters using a travel mode other than a personal vehicle Number of two-wheel motorized vehicles per capita Kilometres of bicycle paths and lanes per 100 000 population Transportation fatalities per 100 000 population Commercial air connectivity (number of non-stop commercial air destinations)
Urban planning (Clause 19)	Green area (hectares) per 100 000 population	Annual number of trees planted per 100 000 population Areal size of informal settlements as a per cent of city area Jobs/housing ratio

Table A.1 *(continued)*

	Core indicator	Supporting indicator
Wastewater (Clause 20)	Percentage of city population served by wastewater collection Percentage of the city's wastewater that has received no treatment Percentage of the city's wastewater receiving primary treatment Percentage of the city's wastewater receiving secondary treatment Percentage of the city's wastewater receiving tertiary treatment	
Water and sanitation (Clause 21)	Percentage of city population with potable water supply service Percentage of city population with sustainable access to an improved water source Percentage of population with access to improved sanitation Total domestic water consumption per capita (litres/day)	Total water consumption per capita (litres/day) Average annual hours of water service interruptions per household Percentage of water loss (unaccounted for water)

Annex B
(informative)

Profile indicators

The list of profile indicators provide basic statistics and background information to help cities determine which cities are of interest for comparisons are shown below and are not included as part of this draft standard. Definitions and methodologies for the profile indicators are now under-development.

Table B.1 — Profile Indicators

	Indicator
People	Total city population
	Population density (per square kilometre)
	Percentage of country's population
	Percentage of population that are children (0-14)
	Percentage of population that are youth (15-24)
	Percentage of population that are adult (25-64)
	Percentage of population that are senior citizens (65+)
	Male to female ratio (number of males per 100 females)
	Annual population change
	Population dependency ratio
	Percentage of population that are foreign born
	Percentage of population that are new immigrants
	Percentage of residents who are not citizens
Housing	Total number of households
	Total number of occupied dwelling units (owned & rented)
	Persons per unit
	Dwelling density (per square kilometre)
Economy	Average household income (USD)
	Annual inflation rate based on average of last 5 years
	Cost of living
	Income distribution (Gini Coefficient)
	Country's GDP (USD)
	Country's GDP per capita (USD)
	City Product per capita (USD)
	City Product as a percentage of Country's GDP
	Employment percentage change based on the last 5 years

Table B.1 *(continued)*

	Indicator
Government	Type of government (e.g. local, regional, county)
	Gross operating budget (USD)
	Gross operating budget per capita (USD)
	Gross capital budget (USD)
	Gross capital budget per capita (USD)
Geography and climate	Region
	Climate type
	Land area (Square kilometres)
	Percentage of non-residential area (square kilometres)
	Number of native species
	Annual average temperature (Celsius)
	Average annual rain (mm)
	Average annual snowfall (cm)

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