

## **COST Action C23**

### ***Strategies for a Low Carbon Urban Built Environment***

Template – CITIES

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#### *Objective:*

1. Prepare a GIS database to characterise and compare, from a low carbon perspective, the overall working of our cities (and/or metropolitan areas)<sup>1</sup> by means of a set of consistent, readily available and easily comparable energy performance indicators.
2. Support an integrated view of the energy performance of the current typologies, building materials and technologies applied in new and existing buildings in the context of the energy performance of the cities in which they are located<sup>2</sup>.
3. Provide background information on the urban context to analyse the impact of
  - a. innovative strategies and technical solutions for low carbon buildings (case studies);
  - b. national and regional energy performance policies and regulations addressed to both new and existing buildings, and to planning and design of urban areas and of urban infrastructures.

#### *Structure of the template in six blocks of information:*

1. general data
2. building stock
3. land use and urban form
4. transport systems
5. resource consumption
6. performance indicators

#### *Space and Time frames<sup>3</sup>*

1. Reference years: 1991 and 2001<sup>4</sup>
2. City (metropolis) boundaries: as close as possible to the employment basin – so that at least 90% of all commuting travel to the city centre is within the study area. Only by chance this criteria corresponds to the official boundaries of our cities and metropolitan areas.
3. Spatial units within city boundaries: smallest statistical subunits and, in a separate layer, the complete street grid.

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<sup>1</sup> An interesting and, somehow, representative sample of European cities covered by the COST C23 membership. The idea is to take advantage of the privileged position that most of us have to contact Local Authorities, Planning Departments and Research Institutions and get access to relevant data and information on our own cities.

<sup>2</sup> Significant differences can still be found in the physical characteristics of the building stock across Europe, from north to south, and east to west.

<sup>3</sup> Following the publication of Census data and the availability of GIS land cover.

<sup>4</sup> Subject to the availability of data.

## CITY Matrix

CITY – xyz		1991	2001
<b>GENERAL DATA</b>			
1	Location – latitude (°N), altitude (m)		
2	Climate – temp. (°C), humidity (%) rainfall (mm) <sup>5</sup>		
3	Resident population		
4	Employment		
5	Overall city / metropolitan surface (km <sup>2</sup> )		
6	Urban area <sup>6</sup> (km <sup>2</sup> )		
7	Green – blue structures (non urban areas) (km <sup>2</sup> ) <sup>7</sup>		
8	Gross population density (inhab/km <sup>2</sup> )		
9	Gross employment density (workplaces/km <sup>2</sup> )		
10	GDP per capita (€)		

<b>BUILDING STOCK</b>			
11	Dwellings per 1000 inhabitants		
12	Average age of the total stock (years)		
13	New construction (m <sup>2</sup> /inhab.yr) <sup>8</sup>		
14	Rehabilitation (m <sup>2</sup> /inhab.yr) <sup>9</sup>		
15	Building functions <sup>10</sup>		
16	Building high <sup>11</sup>		
17	Housing types <sup>12</sup>		

<b>LAND USE AND URBAN FORM</b>			
18	Geometric shape		
19	Mono or polycentric structure		
20	Map of population density		
21	Map of employment density		
22	Concentration of employment in the city centre <sup>13</sup>		
23	Residential concentration index <sup>14</sup>		
24	Public green areas (km <sup>2</sup> ) <sup>15</sup>		
25	Street density in the urban area (km/km <sup>2</sup> )		

<sup>5</sup> Mean annual values.

<sup>6</sup> For the purposes of this exercise urban areas include all areas within city (metropolis) boundaries with gross population densities above 250 inhab/km<sup>2</sup>.

<sup>7</sup> Includes all agricultural and forest lands as well as (non formalized) natural areas, located within city boundaries.

<sup>8</sup> Annual production of new floor space per inhabitant (on average).

<sup>9</sup> Idem for rehabilitation works.

<sup>10</sup> Ratio of (exclusively) residential vs mixed and non residential buildings.

<sup>11</sup> Average number of floors above ground in the whole city.

<sup>12</sup> Ratio of dwellings in unifamily houses vs dwellings in multifamily houses.

<sup>13</sup> Percentage of workplaces in the city centre on the total, for the whole city.

<sup>14</sup> This index is defined as the residents' average distance to the urban centre divided by the average distance they would have had if they were evenly distributed all over the urban area (Naess et al, 1996)

<sup>15</sup> Includes all formalized green areas such as squares, parks and urban green corridors.

<b>TRANSPORT SYSTEMS</b>			
26	Cars per 1000 inhabitants		
27	Provision of public transport (1000 seat.km/km <sup>2</sup> )		
28	Trunk road length per capita (km/inhab)		
29	Street network length per capita (km/inhab)		
30	Modal split (%) <sup>16</sup>		
31	Parking spaces per 1000 city centre workplaces		
32	Density of segregated transit routes (km/km <sup>2</sup> ) <sup>17</sup>		
33	Public vs private infrastructure provision <sup>18</sup>		

<b>RESOURCE COMSUMPTION</b>			
34	Urban area per capita (km <sup>2</sup> /inhab)		
35	Residential floor space per capita (m <sup>2</sup> /inhab)		
36	Energy use in buildings per cap. (kwh/inhab.yr)		
37	Energy use in transports per cap. (kwh/inhab.yr)		
38	Energy use in public transport per capita		
39	Energy use in private transport per capita		

<b>PERFORMANCE INDICATORS</b>			
40	CO <sub>2</sub> emissions per capita (Kg/inhab.yr)		
41	CO <sub>2</sub> emissions per workplace (Kg/workplace.yr)		
42	CO <sub>2</sub> emissions per urban km <sup>2</sup> (tone/km <sup>2</sup> )		
43	CO <sub>2</sub> emissions per city km <sup>2</sup> (tone/km <sup>2</sup> )		
44	CO <sub>2</sub> emissions per residential floor space (kg/m <sup>2</sup> )		
45	CO <sub>2</sub> emissions per GDP (city) (g/€)		

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<sup>16</sup> Percentages of the total journeys carried out by public, private and non motorised transport modes.

<sup>17</sup> Total length of segregated routes occupied by bus, light metro, conventional metro and rail lines divided by the total surface of the urban area.

<sup>18</sup> Ratio of the total length of segregated public transport routes (all modes) by the total length of urban trunk roads (network of urban motorways and fast carriageways) (adapted from Kenworthy & Laube, 2004).