MAPPING GUIDE FOR A EUROPEAN URBAN ATLAS

Document History

Version	Date	Comment	Modified Pages
1.0	17/05/2008	Version issued as part of the Call for tender ENTR 08/29. This version is identical to the release I1.02 of the GSE LAND project	All
1.1	26/08/2010	Implementation of the agreed modifications between the EC and the contractor during the execution of the Urban Atlas project	

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1. EXECUTIVE SUMMARY

This document contains the product description, mapping guidance and class description for the product "Urban Atlas" for the GMES "Urban Atlas" project.

2. SCOPE

This Mapping guide shall guide the service providers generating an Urban Atlas mapping product. In particular it shall provide a guidance to achieve:

– Congruent product attributes such as file format, file attributes;

– Common nomenclature;

– Common look & feel of the product;

– Comparable quality of the product.

3. REFERENCE DOCUMENTS

	Reference	Issue / Revision	Name
RD-1	ITD-0421-RP-0003-C5	I 1.00	C5-Service Validation Protocol

4. MAPPING GUIDE

4.1. Product description

The Urban Atlas service offers a high resolution land use map of urban areas.

The product described in this mapping guide is adapted to European needs (discussed and agreed with DG Regional Policy) and contains information that can be derived mainly from Earth Observation (EO) data with support by other reference data, such as COTS navigation data and topographic maps.

Table 1: Product features

Product features:
Digital thematic map   *Thematic classes based on CORINE LC nomenclature and GUS Legend.*
Input data sources
Earth Observation (EO) Data with 2.5 m spatial resolution multispectral or pan-sharpened (multispectral merged with panchromatic) data. Multispectral data includes near-infrared band.   *Topographic Maps at a scale of 1: 50 000 or larger.*   *COTS navigation data for the road network. (Methodology applied will be defined)*   *Areas of Interest for Urban Atlas Mapping are determined by DG REGIO.*   *Sealing layer based on FTS specifications for degree of sealing for level 3 classes 111 and 112 and level 4 classes (1.1.2.1, 1.1.2.2, 1.1.2.3, 1.1.2.4)*   *All input data should be described by metadata according to the INSPIRE metadata profile specifications and guidelines.*
Ancillary data optional for all classes
COTS navigation data: points of interest, land use, land cover, water areas   *Google Earth (only for interpretation, not for delineation)*   *Local city maps*
Ancillary data required for certain classes
Local zoning data (e.g. cadastral data)   *Field check (on-site visit)*   *Very high resolution imagery (better than 1m ground resolution, e.g. aerial photographs)*
Geometric resolution (Scale)
1:10.000 ; MinMU = 0,25 ha
Geographic projection / Reference system

Product features:
As per user request but uniform within project area.
Positional accuracy
+ / - 5 m
Thematic accuracy (in %)
Minimum overall accuracy for level 1 class 1 "Artificial Surfaces": 85%
Minimum overall accuracy (all classes): 80 %
Methodology for quality control has to be performed according to RD[1]. The Minimum Overall accuracy for level 1 class 1 "Artificial Surfaces" must include both omission and commission errors with other classes within the larger urban zone (LUZ).
Up-date frequency
t.b.d.
Base data topicality
t.b.d
Delivery format
Topological correct GIS file
Single part features
Data type
Vector

4.2. General guidelines

4.2.1. *Pre-processing and geo-coding of EO data*

t.b.d.

4.2.2. *Pre-processing and geometric adaptation of COTS navigation data*

The EO data are the basis for interpretation. In case of geometrical differences between EO data and COTS navigation data, the COTS navigation data has to be corrected towards the EO data.

The pre-processing and application of the COTS navigation data shall be done according to the methodology defined in Annex 1.

4.2.3. *Pre-processing of Topographic Maps*

Topographic maps are used for interpretation of objects. Topographic maps should be used in digital form with precise geo-coding. The usage of printed (analogue) maps is not recommended. In case of geometrical differences between EO data and topographic maps, the erroneous data (either RS-data or topo-maps) needs to be identified using reliable datasets providing spatial reference information. Then the geometry of the mapping product shall be congruent with the correct dataset.

4.2.4. *Classification and Interpretation*

Application of automatic classification routines, as segmentation and clustering may be applied whenever appropriate:

– Automated segmentation and classification to achieve a first differentiation into basic land cover classes (urban vs. forest vs. water vs. other land cover) is possible and upon decision of the service providers;

– As backbone for the object geometry the COTS navigation data network is recommended but only with the method defined in the Annex.

Fulfilling the interpretation rules and data format definitions according to this mapping guide is essential (see below).

4.2.5. *Application of FTS sealing layer*

The FTS - sealing layer is used for classification of the sealing densities of class 1.1 urban fabric in level 3 and level 4.

4.2.6. *Accuracy Assessment and Validation*

Methodology for Accuracy Assessment and Validation has to be defined according to [RD1]. The Minimum Overall accuracy for level 1 class 1

"Artificial Surfaces" must include both omission and commission errors with other classes within the LUZ.

4.2.7. *Data Format of final product:*

ESRI ArcInfo or ArcGIS compatible vector format with polygon topology:

–   Complete coverage in a single map single layer;

–   No overlapping polygons, no gaps, duplicate or missing polygon labels and node overshoots;

–   Final Vectors need to have smooth appearance (no pixel-shaped polygons are allowed). The smoothing shall be done by the service provider by methods still t.b.d. It is to ensure that smoothed vectors still are conformal with the minimum width and minimum mapping units required for objects.

GSELUA_yy
11210*

* given example of the number for UA class 1.1.2.1

GSEL   Ð   for GSELand , UA for Urban Atlas

yy Ð   year of production (p.e. 08 for 2008)

Columns data format:

GSELUA_yy: 5 digits in format Long Integer without decimal places (allowed values: 11110 to 50000 (all class codes))

4.2.8. *Interpretation rules:*

–   The delineation is to be done on the EO Data. EO data should be considered as primary (guiding) data source.

–   The interpretation of the object is done using:

–   the EO Data, the topographic maps and COTS navigation data;

–   auxiliary information including local expertise.

–   The interpreted area should be interpreted with at least 100m extension (100 buffer) to ensure accuracy and continuity of polygons. During the post-processing phase a subset with the spatial extent of the final product will be generated. At the border of this subset (final product) polygons smaller than the MinMU may be present.

–   In areas where two or more scenes overlap, it must be assured, that the most recent data are used for delineation and interpretation.

–   In case of cloud-coverage on the most recent scene the affected part (only this part!) shall be interpreted using a cloudless older scene.

–   If two or more objects overlapping at different levels, the top level is mapped continuously, e.g. Road Bridge over Railway is mapped as seen, the railway polygon is broken and the road is mapped as a contiguous feature.

- In case of two or more objects overlapping on the same height level, the visually dominant and complete object (in use and shape) is mapped continuously. For example a road / railway crossing viewed at the same height level: the railway shall be mapped continuously to maintain the network. The road shall be broken.

Table 2: Product accuracies

	CORINE Class(es) [Level I, No.]	Level(s) provided	MinMU	Thematic Accuracy	Positional Pixel accuracy
M1.1 Urban Atlas	1	I - IV	0,25 ha	>= 85%	<+/- 5m
	2 - 5	I	1 ha	>= 80%	<+/- 5m
Overall accuracy				>= 80%	

4.2.9. _Minimum mapping units:_

- Minimum mapping unit (MinMU):   Class 1 :   0,25 ha
  Class 2 – 5 :   1 ha

Exception of MinMU 0.25 / 1ha : in case of an homogeneous area > MinMU but divided in 2 or more polygons by the road network, each part can be smaller to preserve the land cover information. However, no polygon can be smaller than 500 m² (e.g.: a 1 ha forest divided in 4 polygons by the road network has to be mapped).

- Minimum mapping width (MinMW) between 2 Objects for distinct mapping 10m

- Maximum mapping width (MinMW) between 2 Objects for mapping together 10m

Exception of minimum width 10 m of a mapping unit: to maintain continuity of linear structures, they can be mapped smaller than 10 m over a distance of up to 50m (see figure).
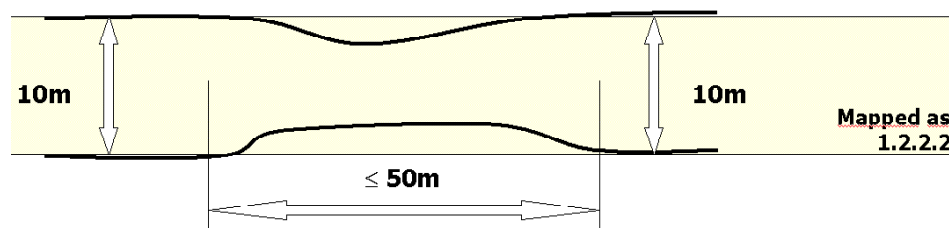
4.2.10. _Priority rules_

Priority mapping rules for areas smaller than the MinMU:

- Smaller areas are added to the adjacent unit with the next lesser number of the same sub-class.

- Smaller areas are added to the adjacent unit of the same upper class

– Smaller areas are added to the adjacent unit with the longest common border line, except to railways or roads (exception here: if an object is below the MMU size and completely surrounded by e.g. road or railway network it shall be aggregated with that surrounding traffic line)

4.2.11. Good practice for data display for delineation:

Mapping scale on screen 1: 5.000

4.3. Visual Examples for Random distributions
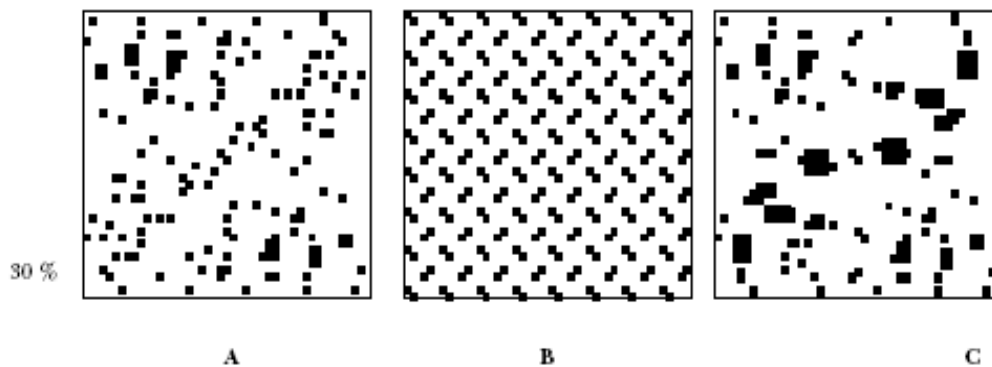
Fig. 64 Random distribution of the forest trees coverage (A, C) and regular distribution (B).

1 %

2 %

5 %

10 %

15 %

20 %

25 %

35 %

40 %

50 %

70 %
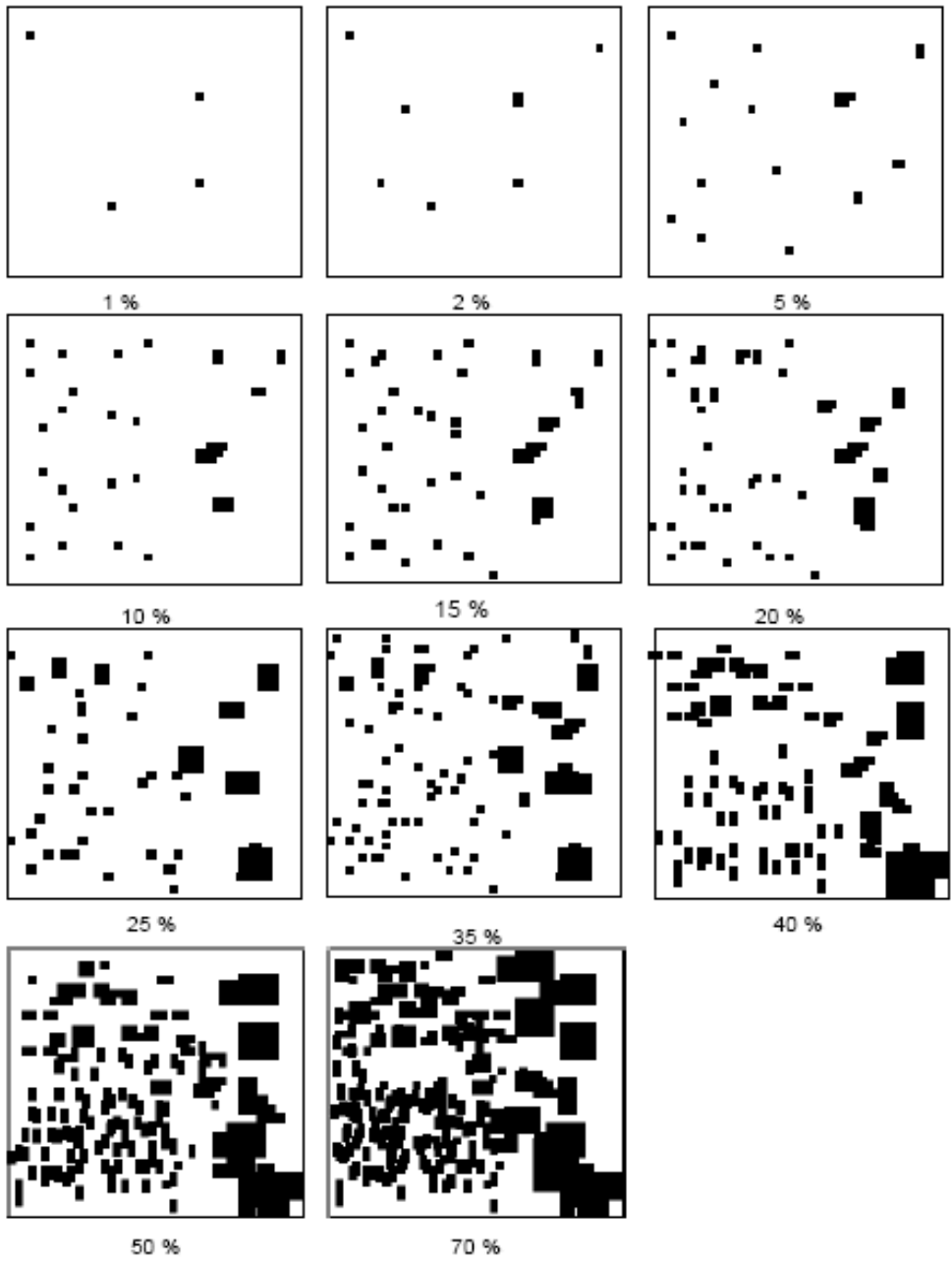
4.4. Legend Table

Table 3: UA nomenclature (in bold: classes without any further subdivision)

UrbanAtlas No.	Vector Data Code	Nomenclature	Additional Information
	GSELUA_yy		
1		Artificial surfaces	
1.1		Urban fabric	
1.1.1	**11100**	**Continuous Urban fabric (S.L. > 80%)**	FTS[1] required
1.1.2	11200	Discontinuous urban fabric (S.L. 10% - 80%)	
1.1.2.1	**11210**	**Discontinuous Dense Urban Fabric (S.L.: 50% - 80%)**	FTS required
1.1.2.2	**11220**	**Discontinuous Medium Density Urban Fabric (S.L.: 30% - 50%)**	FTS required
1.1.2.3	**11230**	**Discontinuous Low Density Urban Fabric (S.L.: 10% - 30%)**	FTS required
1.1.2.4	**11240**	**Discontinuous Very Low Density Urban Fabric (S.L.: < 10%)**	FTS required
1.1.3	11300	Isolated Structures	
1.2		Industrial, commercial, public, military, private and transport units	
1.2.1	**12100**	**Industrial, commercial, public, military and private units**	zoning data / field check recommended
1.2.2	12200	Road and rail network and associated land	COTS[2] navigation data required
1.2.2.1	**12210**	**Fast transit roads and associated land**	COTS navigation data required
1.2.2.2	**12220**	**Other roads and associated land**	COTS navigation data required

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[1] FTS= EEA Fast Track Sealing Layer. The assignment of the sealing levels (i.e. classes 1121-1124) shall be carried out using this layer. QA check will check only if the technical approach agreed with DG REGIO is kept but will not assess the absolute accuracy of these classes.

[2] COTS – Common Of The Shelf

GSELand M1.1 Urban Atlas			
UrbanAtlas No.	**Vector Data Code**	**Nomenclature**	**Additional Information**
1.2.2.3	**12230**	**Railways and associated land**	COTS navigation data required
1.2.3	**12300**	**Port areas**	zoning data / field check recommended
1.2.4	**12400**	**Airports**	zoning data / field check recommended
1.3		Mine, dump and construction sites	
1.3.1	**13100**	**Mineral extraction and dump sites**	
1.3.3	**13300**	**Construction sites**	
1.3.4	**13400**	**Land without current use**	
1.4		Artificial non-agricultural vegetated areas	
1.4.1	**14100**	**Green urban areas**	
1.4.2	**14200**	**Sports and leisure facilities**	
2	**20000**	**Agricultural Areas, semi-natural areas and wetlands**	1 ha MMU
3	**30000**	**Forests**	1 ha MMU
5	**50000**	**Water**	1 ha MMU

4.5. Decision Rules

Decision Matrix				
Land			**Water**	
human activity non-agricultural	little / no human influence, Agriculture, Forestry			
1. Artificial Surfaces	2. Agricultural- + Semi-natural Areas + Wetlands	3. Forests	5. Water	

Ref. Data	Additional Data req.										
Sat.-Image TK COTS navigation data		1. Artificial Surfaces									
		Urban areas with dominant residential use or inner-city areas with central business district and residential use			Industrial, commercial, public, military and private unitsor transport units are predominant				strong human influence on soil surface, buildings not dominant		leisure and recreation use dominates
		1.1 Urban Fabric			1.2 Industrial, commercial, public, military, private and transport units				1.3 Mine, dump and construction sites		1.4 Artificial non-
FTS - Sealing		1.1.1 Continuous Urban Fabric	1.1.2 Discontinuous Urban Fabric	1.1.3 Isolated Structures	1.2.1 Industrial, commercial, public, military and private units	1.2.2 Road and rail network and associated land	1.2.3 Port areas	1.2.4 Airports	1.3.1 Mineral extraction and dump sites	1.3.3 Construction sites	1.3.4 Land without current use	1.4.1 Green urban areas	1.4.2 Sports and leisure facilities
FTS - Sealing			1.1.2.1 (S.L. : 50% - 80%) 1.1.2.2 (S.L. : 30% - 50%) 1.1.2.3 (S.L. : 10% - 30%) 1.1.2.4 (S.L. : 0% - 10%)			1.2.2.1 Fast transit roads and associated land 1.2.2.2 Other roads and associated land 1.2.2.3 Railways and associated land						

4.6. Description of mapping units Urban Atlas

1.   Artificial Surfaces

Surfaces with dominant human influence but without agricultural land use.

These areas include all artificial structures and their associated non-sealed and vegetated surfaces.

Artificial structures are defined as buildings, roads, all constructions of infrastructure and other artificially sealed or paved areas.

Associated non-sealed and vegetated surfaces are functionally related areas to human activities, except agriculture.

Also the areas where the natural surface is replaced by extraction and / or deposition or designed landscapes (as urban parks or leisure parks) are mapped herein this class.

The land use is dominated by permanently populated areas and/ or traffic, exploration, non-agricultural production, sports, recreation and leisure.

1.1.   Urban fabric

Built-up areas and their associated land, such as gardens, parks, planted areas and non-surfaced public areas and the infrastructure, if these areas are not suitable to be mapped separately w.r.t. MinMU size.

Basically the classes 1.1.1 and 1.1.2.x are distinguished by their degree of soil sealing.

Residential structures and patterns are predominant, but also downtown areas and city centres, with the central business districts (CBD) and with partial residential use are included.

The Urban Fabric classes (1.1.x) are distinguished only by their degree of soil sealing not by their type of buildings (single family houses or apartment blocks).

The detailed descriptions of the different classes below are given to the interpreters to support the delineation of mapping objects with homogeneous sealing density (without being required to assign the exact density classes)

Using the COTS navigation data as a skeleton for the urban area, in many cases it is necessary to subdivide the blocks formed by the COTS navigation data due to different sealing density of the residential areas or different functions of the buildings and their associated land.

After completion of the interpretation the sealing level information from the FTS sealing layer is integrated into the data.

1.1.1. Continuous Urban Fabric

Special Note: Mapping the 3rd level is done only with the defined application of the FTS Sealing layer.

MinMU 0,25 ha, Minimum width: 10 m

Land Cover:

Average degree of soil sealing: > 80%

Built-up areas and their associated land, if these areas are not suitable to be mapped separately w.r.t. MinMU size.

Buildings, roads and sealed areas cover most of the area; non-linear areas of vegetation and bare soil are exceptional.

Land Use:

Predominant residential use: areas with a high degree of soil sealing, independent of their housing scheme. (Single family houses or high rise dwellings, city centre or suburb).

Included are downtown areas and city centres, central business districts (CBD) as long there is partial residential use.

1.1.2. Discontinuous Urban Fabric

Special Note: Mapping the 4th level of density classes is done only with the defined application of the FTS Sealing layer.

Land Cover:

Average degree of soil sealing: 0 - 80%

Built-up areas and their associated land (small roads, sealed areas including non-linear areas of vegetation and bare soil), if these areas are not suitable to be mapped separately w.r.t. MinMU size.

This type of land cover can be distinguished from continuous urban fabric by a larger fraction of non-sealed and / or vegetated surfaces: gardens, parks, planted areas and non-surfaced public areas.

Land Use:

Predominant residential usage. Contains more than 20 % non – sealed areas, independent their housing scheme. (Single family houses or high rise dwellings, city centre or suburb).

The non – sealed areas might be private gardens or common green areas.

Not included are:

Farms with large buildings (agro-industrial production), ∂ class 1.2.1;

Nurseries with dominant areas of greenhouses (no or only small fields) ∂ class 1.2.1;

Allotment gardens ∂ class 1.4.;

Holiday villages ("Club Med") ∂ class 1.4.2.

1.1.2.1 Discontinuous Dense Urban Fabric

MinMU 0,25 ha, Minimum width: 10 m

Average degree of soil sealing: >50 - 80%

Residential buildings, roads and other artificially surfaced areas.

1.1.2.2 Discontinuous Medium Density Urban Fabric

MinMU 0,25 ha, Minimum width: 10 m

Average degree of soil sealing: >30 - 50%

Residential buildings, roads and other artificially surfaced areas. The vegetated areas are predominant, but the land is not dedicated to forestry or agriculture.

1.1.2.3 Discontinuous Low Density Urban Fabric

MinMU 0,25 ha, Minimum width: 10 m

Average degree of soil sealing: 10 - 30%

Residential buildings, roads and other artificially surfaced areas. The vegetated areas are predominant, but the land is not dedicated to forestry or agriculture.

1.1.2.4 Discontinuous Very Low Density Urban Fabric

MinMU 0,25 ha, Minimum width: 10 m

Average degree of soil sealing: <10 %

Residential buildings, roads and other artificially surfaced areas. The vegetated areas are predominant, but the land is not dedicated to forestry or agriculture. Example: exclusive residential areas with large gardens.

1.1.3. Isolated Structures

*MinMU 0,25 ha, **MaxMU: 2ha**, Minimum width: 10 m*

Isolated artificial structures with a ***residential component***, as such as (small) individual farm houses and related buildings.

The mapping unit will never be surrounded by any urban class other than transportation network.

The mapping unit is not larger than 2 ha.

Exception: Border blocks / polygons in housing developments (they may adjacent to roads and non-urban classes).

1.2. Industrial, commercial, public, military, private and transport units

At least 30% of the ground is covered by artificial surfaces. More than 50% of those artificial surfaces are occupied by buildings and / or artificial structures with non-residential use, i.e. industrial, commercial or transport related uses are dominant

1.2.1. Industrial, commercial, public, military and private units

MinMU 0,25 ha, Minimum width: 10 m

Land Cover:

Artificial structures (e.g. buildings) or artificial surfaces (e.g. concrete, asphalt, tar, macadam, tarmac or otherwise stabilised surface, e.g. compacted soil, devoid of vegetation), occupy most of the surface.

Included are associated areas, such as roads, sealed areas, vegetated areas, if these areas are not suitable to be mapped separately w.r.t. MinMU size.

Land Use:

Industrial, commercial, public, military or private units. The administrative boundaries of the production or service unit are mapped, included associated features larger than the MinMU. (e.g. sporting areas or transport structures).

Comprised are also:

– Bare soil and/or grassland potentially used for storage of material or standing-out of livestock.

– Compounds with significant amount of green or natural areas but with industrial, commercial, military or public use. Example: communication tower, antennas or wind motors and their associated land.

This class contains:

a) Industrial uses and related areas:

– Sites of industrial activities, including their related areas;

– Production sites;

– Energy plants: nuclear, solar, hydroelectric, thermal, electric and wind farms;

– Sewage-treatment plants;

– Farming industries. (Farms with large buildings or / and greenhouses, not fields of production);

– Antennas, even with predominant vegetated areas. The vegetated areas may be predominant, but the land is not dedicated to forestry or agriculture;

– Water treatment plants;

– Sewage plants;

– Seawater desalination plants.

The industrial units can be distinguished from residential build up areas by the type of buildings, their access to transport features and the surroundings:

– Large area buildings, (inside not all rooms need day light as in dwelling houses);

– Good access to traffic ways and parking for customers;

– Industrial areas are often outside the historical city centre.

b) Commercial uses, retail parks and related areas

– Surfaces purely occupied by commercial activities, including their related areas (e.g. parking sites even larger as MinMU);

– High rise office buildings;

– Petrol and service stations within built-up areas.

The commercial units can be distinguished from residential build up areas by the type of large buildings, their access to transport features and the surroundings:

– large area buildings, (inside not all rooms need day light as in dwelling houses);

– Good access to traffic ways and parking for customers;

– Pure Commercial areas are often outside the historical city centre.

Not included are:

Petrol stations along fast transit and main roads with access only from this road. They are mapped together with the road transport system Ö class 1.2.2 1 or 1.2.2.2.

c) Public, military and private services not related to the transport system

Surfaces purely occupied by general government, public or private administrations including their related areas (access ways, lawns, parking areas).

Included are:

– Schools and universities;

– Hospitals and other sanitary services/buildings;

– Places of worship (churches/cathedrals/religious buildings);

– Cemeteries;

– Archaeological sites and museums;

– Administration buildings, ministries;

– Penitentiaries;

– Military areas including bases and airports;

– Military exercising areas fenced and under current use;

– Castles etc. not primarily used for residential purposes (building management, gardeners etc. living there is not residential use in this sense);

– Private storage areas without residential component as compounds of garages.

Not included are:

Public parks Ō class 1.4.1

Holiday resorts including their hotels Ō class 1.4.2

Sport Centres or bathing centres Ō class 1.4.2

d) Civil protection and supply infrastructure

– Dams, dikes, irrigation and drainage canals and ponds and other technical public infrastructure, to be mapped including the roads, embankments and associated land;

– Includes also breakwaters, piers and jetties. sea walls and flood defences;

– (Ancient) City walls, other protecting walls, bunkers;

– Avalanche barriers.

Not included are:

Noise barriers Ō class 1.2.2.x;

Water courses (within e.g. diked canals) if water area is wider than 10m Ō class 5;

Reservoirs along natural water courses Ō class 5.

1.2.2.   Road and Rail network and associated land

Special Note:

The road and railway network (COTS navigation data) is ingested into the classification database according to the method given in the Annex.

Parts of the COTS navigation data that are obviously not congruent with the corresponding traffic line in the EO data and topomap need to be corrected

Roads which are not contained in the COTS navigation data are mapped by the Service provider according the mapping criteria defined herein this mapping guide.

Roads or Railroads does not necessarily have to form a closed network. Isolated traffic lines are possible, but they are to be mapped w.r.t. MinMU criterion.

Associated land is mapped towards the roads/railways as it is visible in the EO data and topographic maps.

Associated lands are:

– Slopes of embankments or cuts;

– Enclosed areas by roads, railways without direct access and without agricultural land use;

– Fenced areas along roads (protection against wild animals);

– Areas enclosed by motorways, exits or service roads with no detectable access;

– Noise barriers (fences, walls, earth walls);

– Rest areas, service stations and parkings only accessible from the fast transit roads;

– Railroad facilities including stations, cargo stations and service areas;

– Foot- bicycle paths parallel to the traffic line;

– Green strips, alleys (with trees or bushes).

1.2.2.1   Fast transit roads and associated land

MinMU 0,25 ha, Minimum width: 10 m

Motorways with COTS navigation data attribute "Motorways" and motorway rest and service areas and parkings, only accessible from the motorways.

Motorways that are not included in the COTS navigation data are to be mapped by the Service provider.

1.2.2.2 Other roads and associated land

MinMU 0,25 ha, Minimum width: 10 m

Roads, crossings, intersections and parking, including roundabouts, sealed areas with "road surface"

1.2.2.3 Railways and associated land

MinMU 0,25 ha, Minimum width: 10 m

Railroad facilities including stations, cargo stations and service areas.

1.2.3. Port areas

MinMU 0,25 ha, Minimum width: 10 m

Special Note:

Ancillary data is recommended to identify the administrative boundary of the port area. The delineation itself is to be done on the EO data:

– Detailed city / tourist maps or

– Field check (On site visit) or

– Local zoning data

Administrative area of inland harbours, sea ports.

Infrastructure of port areas, including quays, dockyards, transport and storage areas and associated areas.

Not included are:

Marinas Ɵ class 1.4.2.

1.2.4. Airports

MinMU 0,25 ha, Minimum width: 10 m

Special Note:

Ancillary data is recommended to identify the administrative boundary of the port area. The delineation itself is to be done on the EO data:

– Detailed city / tourist maps or

– Field check (On site visit) or

– Local zoning data

Administrative area of airports, mostly fenced.

Included all airport installations: runways, buildings and associated land.

Not included are:

Aerodromes without sealed runway Ö class 1.4.2.

1.3. Mine, dump and construction sites

1.3.1. Mineral extraction and Dump sites

MinMU 0,25 ha, Minimum width: 10 m

Special Note:

Ancillary data is recommended to identify the administrative boundary. The delineation itself is to be done on the EO data:

– Detailed city / tourist maps or

– Field check (On site visit) or

– Local zoning data

Included are: open pit extraction (sand, quarries) incl. water surface, if < MinMU, open-cast mines, *__inland salinas__*, oil and gas fields;

Included are: their protecting dikes and / or vegetation belts and associated land as e.g. service areas, storage depots;

Included are: public, industrial or mine dump sites, raw or liquid wastes, legal or illegal, their protecting dikes and / or vegetation belts and associated land as e.g. service areas.

Not included are:

Water bodies > MinMU Ö class 5;

Exploited peat bogs Ö class 2;

Coastal salinas Ö class 2;

Re-cultivated areas (mapped according their actual land cover) Ö class 2 or 3;

River bed extraction Ö class 2;

Decanting basins of biological water treatment plants Ö class 1.2.1.

1.3.3 Construction sites

MinMU 0,25 ha, Minimum width: 10 m

Spaces under construction or development, soil or bedrock excavations for construction purposes or other earthworks visible in the image.

Clear evidences of actual construction need to be identifiable in the data, such as actual excavations and machinery on site, or ongoing construction of any stage etc.

In case of doubt ᴆ class 1.3.4

1.3.4 Land without current use

MinMU 0,25 ha, Minimum width: 10 m

Areas in the vicinity of artificial surfaces still waiting for being used or re-used. The area obviously in a transitional position, "waiting for being used".

Waste land, removed former industry areas, ("brown fields") gaps in between new construction areas or left over land in the urban context ("green fields").

No actual agricultural or recreational use.

No construction is visible, without maintenance, but no undisturbed fully natural or semi-natural vegetation, (secondary ruderal vegetation).

Also areas where street network is already finished, but actual erection of buildings still not visible.

Not included are:

"Left over areas", areas too small / narrow for any construction w.r.t. MinMU size ᴆ map to the appropriate neighbour class as associated land.

1.4. Artificial non-agricultural vegetated areas

Vegetation planted and regularly worked by man, strongly human influenced.

Sporting facilities as functional units independent of being not sealed, sealed or build up.

1.4.1. Green urban areas

MinMU 0,25 ha, Minimum width: 10 m

Public green areas, predominant recreational use as gardens, zoos, parks, castle parks,

Suburban natural areas that have become and are managed as urban parks.

Forests or green areas extending from the surrounding into urban areas are mapped as green urban areas when at least two sides are bordered by urban areas and structures and traces of recreational use are visible.

Not included are:

Private gardens within housing areas ᴆ class 1.1;

Cemeteries ᴆ class 1.2.1;

Buildings within parks as castles or museum ᴆ class 1.2.1;

Patches of natural vegetation or agricultural areas being enclosed by built up areas without being managed as green urban area ᴆ class 1 .x.

1.4.2. Sports and leisure facilities

MinMU 0,25 ha, Minimum width: 10 m

All sports and leisure facilities including associated land, independent if public or commercially managed: e.g. Theresienwiese (Munich), Public arenas for any kind of sports incl. associated green areas, parking places etc.:

– Golf courses;

– Sports fields (also outside the settlement area);

– Camp grounds;

– Leisure parks;

– Riding grounds;

– Racecourses;

– Amusement parks;

– Swimming resorts etc.;

– Holiday villages ("Club Med");

– Allotment gardens[3];

– Glider or sporting airports, aerodromes without sealed runway;

– Marinas.

Not included are:

Private gardens within housing areas Ö class 1.1;

Motor racing courses within industrial zone used for test purposes Ö class 1.2 1;

Caravan parking used for commercial activities Ö class 1.2.1;

Soccer fields etc. within e.g. military bases or within university campus Ö class 1.2.1;

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[3] Allotment gardens are complexes of few up to hundreds of land parcels assigned to residential people. Most of the parcels contain individual cultivation areas with fruits, mainly vegetables as well as a shed for tools and shelter.

2. **Agricultural + Semi-natural + Wetland areas**

MinMU 1 ha

a) **Arable land:**

– Fields under rotation system. Can be non-irrigated or permanently irrigated. Includes also rice field;

– Fields laid in fallow are included.

b) **Permanent crops:**

– Fruit orchards, scattered fruit trees with pasture;

– Vineyards and their nurseries;

– Roses;

– Olive groves;

– Berries and hop plantations.

c) **Pasture & natural grassland:**

– Grassland;

– Pasture and meadow under agricultural use, grazed or mechanically harvested.

d) **Shrubs and / or herbaceous Vegetation incl. transitional woodland**

– Vegetation cover more than 50%, ground coverage of trees with height > 5 m: < 30%, areas with minor / without artificial or agricultural influence;

– Sclerophyllous vegetation;

– bushy sclerophyllous vegetation (e.g. maquis, garrigue);

– Abandoned arable land with bushes;

– Woodland degradation: storm, snow, insects or air pollution;

– Areas under power transmission lines inside forest;

– Fire breaks;

– Steep bushy slopes of eroded areas;

– Abandoned vineyards or orchards, arable land and pasture land under natural colonisation;

– Dehesas with bush proliferation indicating no agricultural or farming use for a rather long time;

– Bushy areas along creeks;

e)   Moors and Heathland:

– Bushes, shrubs and herbaceous plants, dwarf forest in alpine or coastal regions (Pinus Mugo forests) Height is maximum 3 m in climax stage.

f)   Beaches, dunes, sands:

– < 10% vegetation cover;

– Beaches, dunes and sand plains, (coastal or inland location), gravels along rivers;

– Seasonal rivers, if water is characteristic in shorter part of the year (< 2 months).

g)   Bare rocks:

– > 90% of the land surface bare rocks, (i.e. < 10% vegetation);

– Rocks, gravel fields, landslides;

– Scree, (fragments resulting from mechanical & chemical erosion. Weathering rocks forming heaps of coarse debris at the foot of steep slopes), cliffs, rocks.

h)   Sparsely vegetated areas:

– Steppes, tundra, badlands, scattered high altitude vegetation. Bare soils inside military training areas. Vegetation cover 10 - 50%.

i)   Burnt areas:

– Recently burnt forest or shrubs (but not natural grassland), still mainly black on EO data.

j)   Snow and ice:

– Glacier and perpetual snow.

k)   Inland wetlands:

– areas flooded or liable to flooding during a great part of the year by fresh, brackish or standing water with specific vegetation coverage made of low shrub, semi-ligneous or herbaceous species;

– Water fringe vegetation, reed beds of lakes, rivers and brooks. Sedge and fen-sedge beds, swamps;

– Peat bogs, with or without peat extracting areas;

– Shallow water areas covered with reed;

– Seasonal rivers, if water course is not visible in the EO Data.

l) Coastal wetlands:

– Areas, flooded or liable to flooding during the great part of the year by brackish or saline water, susceptible to flooding by sea water. Often in the process of filling in and gradually being colonized by halophytic plants;

– Specific vegetation coverage made of low shrub, semi-ligneous or herbaceous species.

– Alluvial planes, marshes and intertidal flats;

– Salinas (salt production sites by evaporation).

Not included are:

Military exercising areas fenced and under current use Ö class 1.2.1 Greenhouses Ö class 1.2.1 Inland salinas Ö class 1.3 1.

3. Forest (natural and plantation)

MinMU 1 ha

– With grounds coverage of tree canopy > 30%, tree height > 5 m, including bushes and shrubs at the fringe of the forest;

– Included are plantations as Populus plantations, Christmas tree plantations;

– Forest regeneration / re-colonisation: Clear cuts, new forest plantations.

Not included are:

Forest within urban areas and human pressure respectively Ö class 1.4.1

5. Water

MinMU 1 ha

The visible water surface area on the EO Data is delineated. EO data should be considered as primary (guiding) data source.

– Sea;

– Lakes;

– Fish ponds (natural, artificial);

– Rivers, incl. channelled rivers;

– Canals.

Default source for delineation is the EO data. If no clear delineation is possible using EO data the other reference datasets may be used for that. Examples are:

- – Reservoirs;

- – Water courses or ponds with strongly variable surface level

All of water bodies and water courses visible in the imagery are mapped as long as they exceed an extent of 1 ha.

Water courses are mapped continuously also when water surface is covered by vegetation. If the water is partly obscured e.g. by vegetation the delineation shall be oriented at other parts of the water where it is not obscured.

Included are: seasonal rivers, if the water course is visible in the EO Data, otherwise Õ class 2.

Fish ponds with distance < 10 m are mapped together.

COTS navigation data water layer may be used as reference for interpretation. However, delineation of water areas must be done using the EO data, as the geometric of accuracy of COTS navigation data water object is too coarse for mapping in scale 1:10.000.

Not included are:

Shallow water areas covered with reed > MinMU Õ class 2 Seasonal rivers, if water course is not visible in the EO Data Õ class 2

5. ANNEX

5.1. Pre-processing and geometric adaptation of COTS navigation data

The COTS navigation data by default comes with a certain categorisation of its street network. Two basic categories are important within the context of the Urban Atlas. The first category gives information about the Functional Road Class (FRC) of each road, the second one gives information about the importance of each road within the city traffic network (Net2Class).

The COTS navigation data currently used shows the following categories for FRC and Net2Class:

FRC	Full name
0	Motorway, Freeway or other Major Road
1	Major Road less important than a Motorway
2	Other Major Road
3	Secondary Road
4	Local Connecting Road
5	Local Road of high importance
6	Local Road
7	Local Road of minor importance
8	Other Road

Net2Class	Importance Level
0	First class (Highest)
1	Second class
2	Third class
3	Fourth class
4	Fifth class
5	Sixth class
6	Seventh class (Lowest)

Usage of COTS navigation data for the Urban Atlas:

The COTS navigation data will be used to generate the street and railroad network of the mapping product. This network will serve as a "backbone" and is decisive for the look & feel of the final product.

The data is delivered in line vector format by the data provider. These lines need to be widened so that the traffic line network of the final product covers the transport areas in the EO data.

For that purpose a usage and buffering strategy was developed to implement the COTS navigation data into the product.

The integration of the traffic network shall be done in advance to all other visual or (semi) automatic delineation and labeling of objects.

The goal of the traffic line implementation process is to ingest a traffic line network into the mapping product that covers all traffic lines wider than 10m (including their associated land – see traffic line description: chapter 6, class 1.2.2) and – on the other hand – being cost-efficient to integrate.

To achieve that goal the following strategy was developed:

– The railway network is delineated individually if it exceeds a minimum width of 10m incl. its associated land.

– The most important roads (FRC classes 0, 1) will be delineated individually.

– The majority of the roads (FRC classes 2 to 5) will be ingested by buffering the line vectors. The buffered roads will have an overall width of at least 10m. The buffering width for each FRCclass will be adapted to the local conditions of each individual city to resemble the overall characteristics of the local traffic network.

– Certain roads (FRC class 6 and above) will be mapped if available (by buffering) or left out according to the decision of the service provider. This is to preserve a common look and feel of the mapping products of different cities.

The following table gives an overview on the treatment of the COTS road network:

	Net2Class			
FRC	**1**	**2**	**3**	**4**
0	Manual			
1	Manual			
2	Estimated buffer width	Estimated buffer width	Estimated buffer width	Estimated buffer width
3	Estimated buffer width	Estimated buffer width	Estimated buffer width	Estimated buffer width
4	Estimated buffer width	Estimated buffer width	Estimated buffer width	Estimated buffer width
5	Estimated buffer width	Estimated buffer width	Estimated buffer width	Estimated buffer width
6 and above	Mapping decided on city by city basis			

The general procedure for the road buffering is as follows:

PRE-PROCESSING

– Identification of the different combinations for fields NET2CLASS and FRC.

– Decision whether to include FRC=6 or not based on visual inspection.

– Sampling of a number of streets (up to service provider) for each combination.

– Estimation of mean width for each combination.

– Recommended is the use of VHR imagery (e.g. GoogleEarth). If city not available at VHR, a city with similar morphology in the same country may be used along with the EO data for production).

PROCESSING

– Buffering implementation

– Manual delineation of streets FRC=0 and 1

POST-PROCESSING

– Manual delineation of streets wider than 10m that have not been buffered previously (i.e. not present in the street network layer or belonging to combinations not considered for buffering).

– Correction (elimination/edition) of errors due to inaccuracies of the line street network or buffering process.

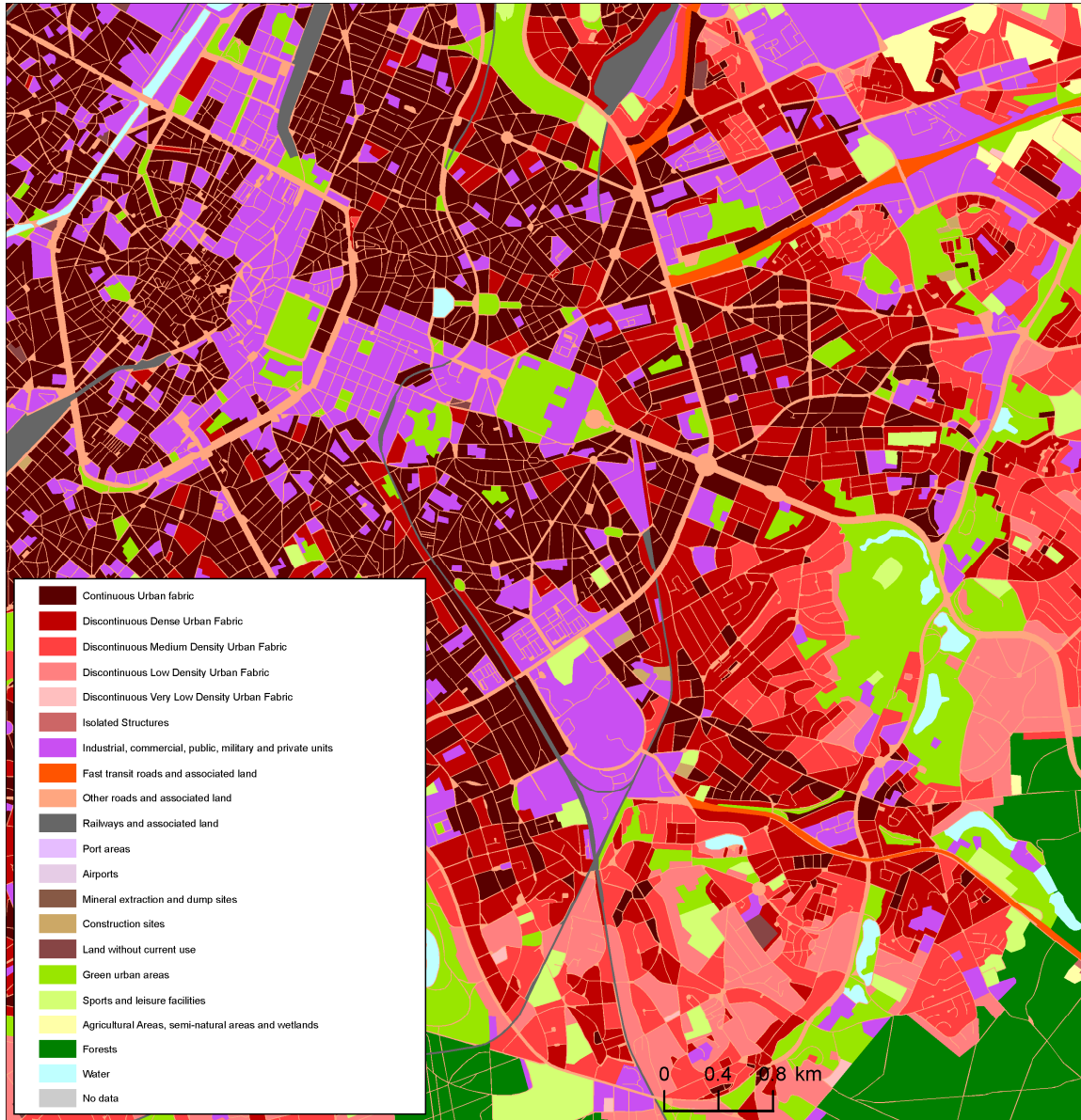Post-processing will be implemented according to SP's production chain

Figure 1: Example of the "Look & Feel" of the final Urban Atlas product for Brussels.

Legend:
- Continuous Urban fabric
- Discontinuous Dense Urban Fabric
- Discontinuous Medium Density Urban Fabric
- Discontinuous Low Density Urban Fabric
- Discontinuous Very Low Density Urban Fabric
- Isolated Structures
- Industrial, commercial, public, military and private units
- Fast transit roads and associated land
- Other roads and associated land
- Railways and associated land
- Port areas
- Airports
- Mineral extraction and dump sites
- Construction sites
- Land without current use
- Green urban areas
- Sports and leisure facilities
- Agricultural Areas, semi-natural areas and wetlands
- Forests
- Water
- No data