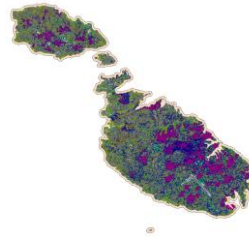


MapMalta



by Antonello Rizzo Naudi

29 January 2020



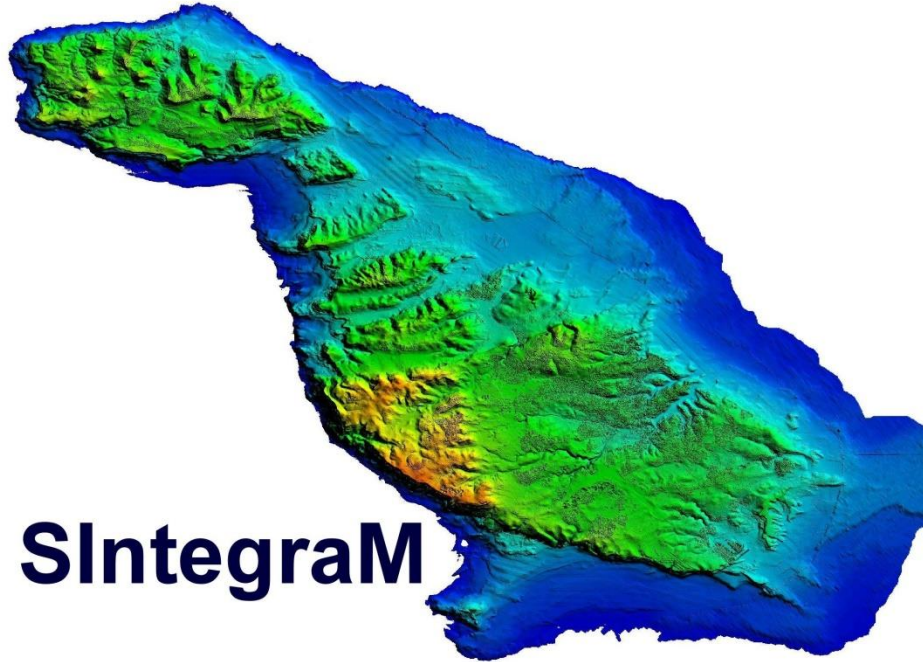
Project Overview



MapMalta basemap forms part of a project, entitled 'SIntegraM: Spatial Integration for Malta Developing Integrated National Spatial Information Capacity', which is co-funded by the European Regional Development Fund (ERDF) and the Maltese Government.

The project aims to source and integrate spatial data in a cohesive and exchangeable *modus operandi* across all government entities. This project will ensure that Malta has an updated basemap that is common to all entities, all data are converted into common formats, systems are inter-linked, data are exchanged and that hardware and software exist to create, manage and maintain such systems.





SIntegraM

Professor Saviour Formosa – *Project Ideator*

Ms. Ashley Hili – *Project Leader*

Ms. Carol Agius – *Topographic Mapping Expert*

The Planning Authority (PA) has a legal obligation “to carry out national mapping, including carrying out land surveys of specific areas and keeping up to date the national geographical database....”

Basemap – Background



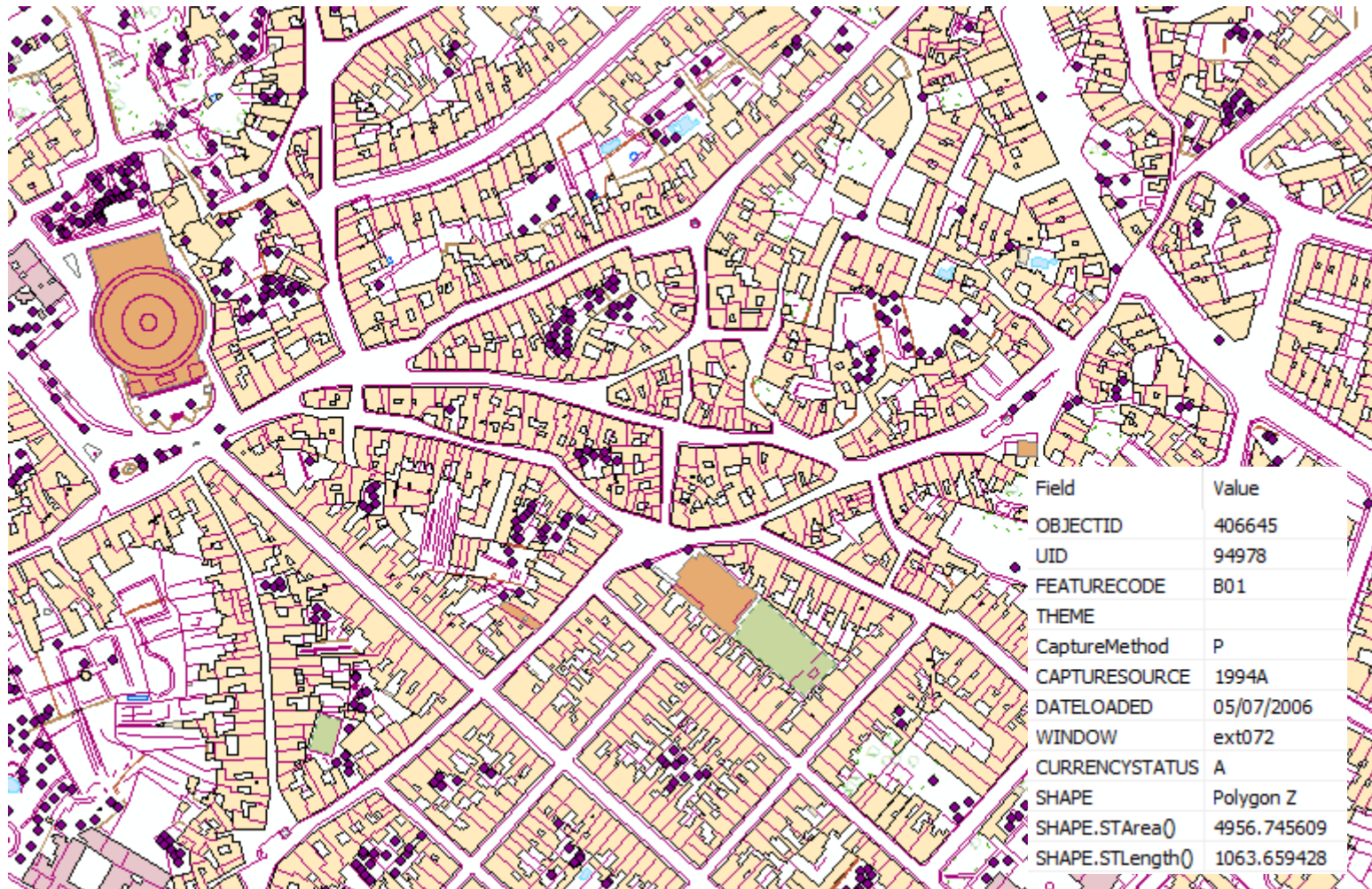
The old topography layer of the Large Scale Topography Map(LSTM) is a vector dataset composed of largely unstructured ('spaghetti') data, with polygons for building features and polylines for many of the other features. The older data model is a flat model with three feature classes (depicting the geometry: point, polyline and polygon).

Features are coded by an alphanumeric feature code and other attributes which include capture source, method, and currency.

The current model offers little intelligence or opportunity for analysis and interpretation by GIS software and tools.



Basemap – Background



Why *new capture* and not *re-engineering* old data?

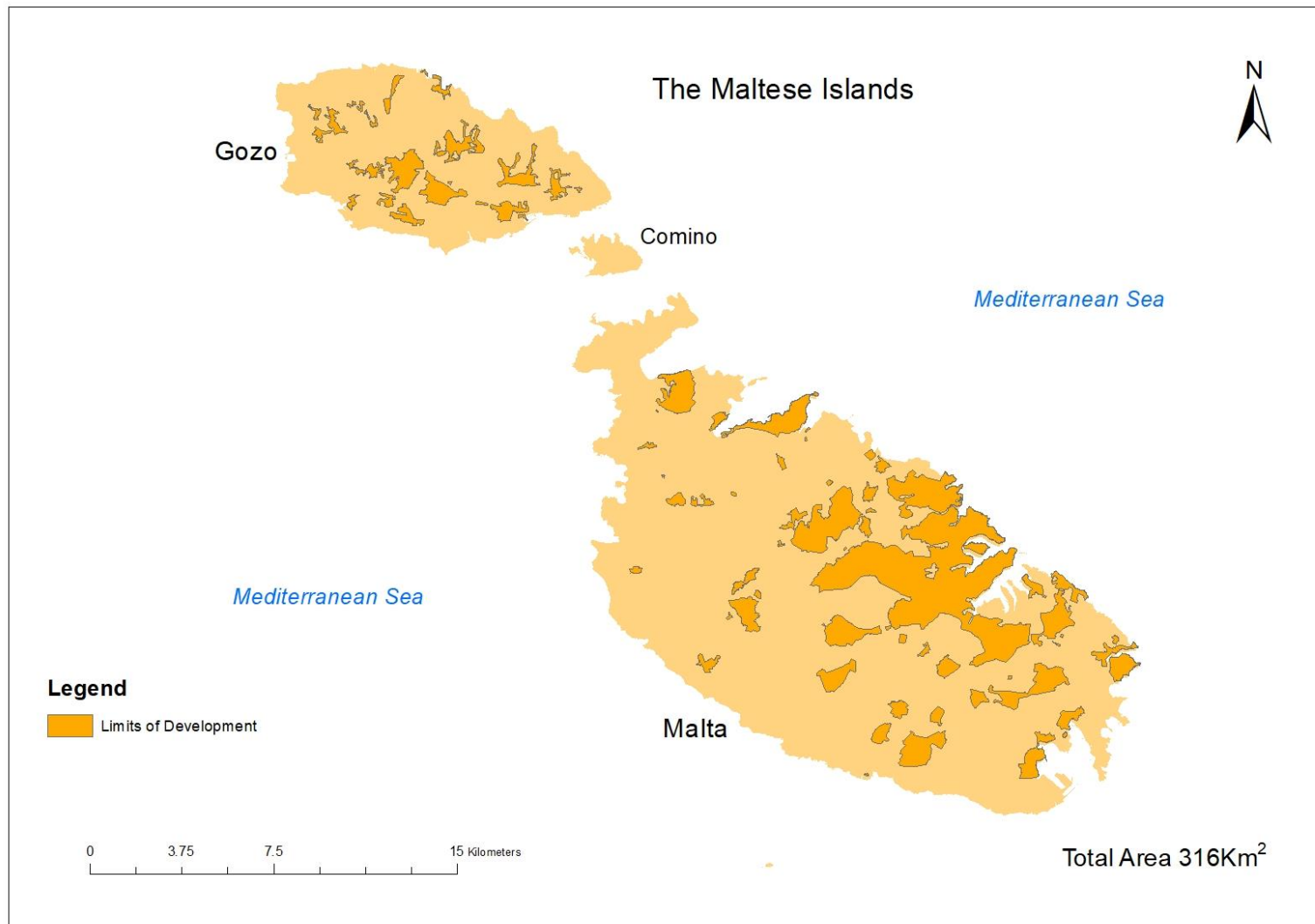
Total area of the Maltese Islands is 316km²

A third of the total area is urban fabric

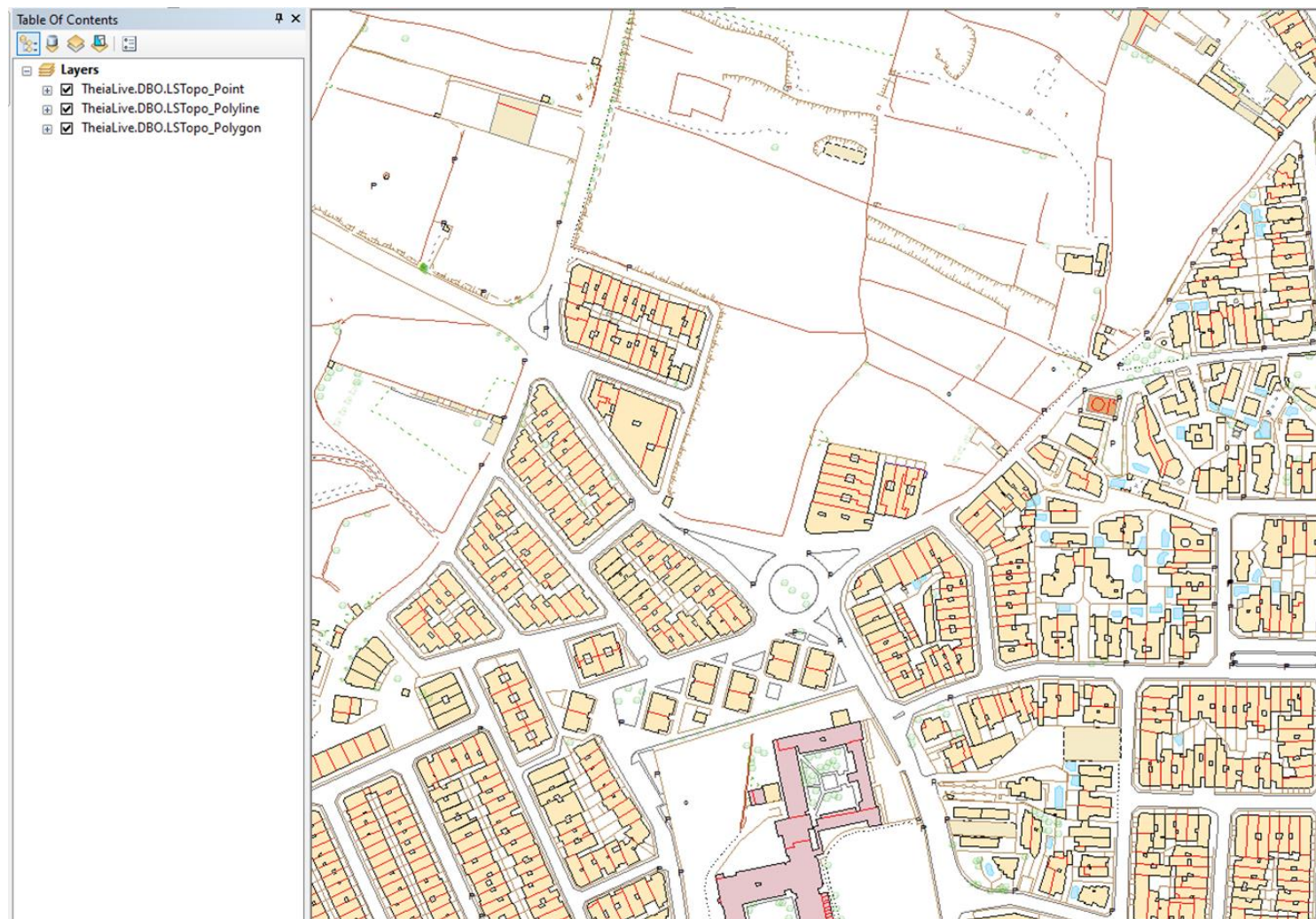
The rest of the area is rural, which is prominently agricultural

Old data lacked sound lifecycle management

MapMalta



MapMalta



A prototype area was identified which was beneficial to the project as it gave the contractor the opportunity to experience in detail the terrain of the Maltese Islands

The design and implementation of MapMalta was built on the expertise of IIC Technologies and Ordnance Survey, with the experienced guidance of the Mapping Unit

The feature catalogue gives an informative overview of the feature types and data types defined in the MapMalta data model

Definition and description of application schema

Definition of attribute values

The names and definitions of feature types

List of domain values

Feature attributes and geometry

Feature Capture Guide

The Feature Catalogue for the Creation of a Large-Scale Topographic Base Map of Malta (MapMalta). It is for use during initial capture and subsequent maintenance of MapMalta.

Title:

Hard Building

Definition:

A permanent construction, often walled, roofed with masonry and/or concrete, or well-constructed metal panels or similar.

Data Capture Statements:

See [Buildings](#) in the main specification. Captured where at least 1mx1m and 1.8m high.

See permanence section of specification for examples of features which are not captured.

Function is recorded where possible - n/a is used if it is unknown or the building has no function.

Featureclass(es):

[OverlaidArea0](#)

[OverlaidAreaPlus2](#)

[OverlaidAreaPlus1](#)

Type:

Feature type

Attributes:**Function- Mandatory**

Values: Bus Shelter,Church,Industrial Building,Lighthouse,Petrol Station,Public Building,Sports Stadium,n/a



Attributes Information

Then

Field	Value
OBJECTID	427868
UID	85497
FEATURECODE	B01
THEME	
CaptureMethod	P
CAPTURESOURCE	1994A
DATELOADED	05/07/2006
WINDOW	Ext057
CURRENCYSTATUS	A
SHAPE	Polygon Z
SHAPE.STArea()	1666.140443
SHAPE.STLength()	237.514401

Now

Field	Value
OBJECTID	132849
GlobalID	{AE3092C8-A835-4E19-BFF2-238E62CFF597}
Creator	IIC
Creation_Date	09/04/2019 12:00:00
Last_Editor	<null>
Last_Edited_Date	<null>
method	Stereoscopic Photogrammetry
source	Aerial Photography
type	Hard Building
theme	Buildings
baseFunction	n/a
heightAboveSeaMin	82.431
heightAboveSeaMax	95.857225
buildingName1	<null>
buildingLanguage1	n/a
buildingName2	<null>
buildingLanguage2	n/a
confidenceLevel	Confident
Shape	Polygon Z
created_user	<null>
created_date	<null>
last_edited_user	<null>
Shape.STArea()	1719.278076
Shape.STLength()	231.365342

Attributes Definition

Attribute	Definition
GlobalID	A field of type Universal Unique Identifier in which values are automatically assigned by the geodatabase when a row is created
Creator	Stores the names of users who created features or records
Creation Date	Stores the date features or records were created
Last editor	Stores the names of users who last edited features or records
Last Edited Date	Stores the date features or records were last edited
Type	The primary and most detailed classification of a feature
Theme	A high level classification grouping together multiple types into similar categories
BaseFunction	A classification detailing what a feature is used for. Applicable on a subset of types
HeightAboveSeaMin	The lowest elevation point at which a feature intersects the ground.
HeightAboveSeaMax	The highest elevation point on a feature.
BuildingName	The accepted name of a building. Each building can have up to two names allowing for Maltese and English names to be captured. This is applicable to features with a type of Hard Building.
BuildingLanguage	Records the language that the building name is in
ConfidenceLevel	Records the confidence in the position and/or attribution of a feature

Feature Classification

type

=	<>	Like
>	>=	And
<	<=	Or
-	%	()
Not		

- 31 - Hard Building
- 32 - Light Building
- 34 - Ruins
- 35 - Thick Wall
- 36 - Stairs
- 42 - Covered Tank Or Silo

theme

=	<>	Like
>	>=	And
<	<=	Or
-	%	()
Not		

- Buildings - Buildings
- Structures - Structures

baseFunction

=	<>	Like
>	>=	And
<	<=	Or
-	%	()
Not		

- Bus Shelter - Bus Shelter
- Church - Church
- Greenhouse - Greenhouse
- Industrial Building - Industrial Building
- Lighthouse - Lighthouse

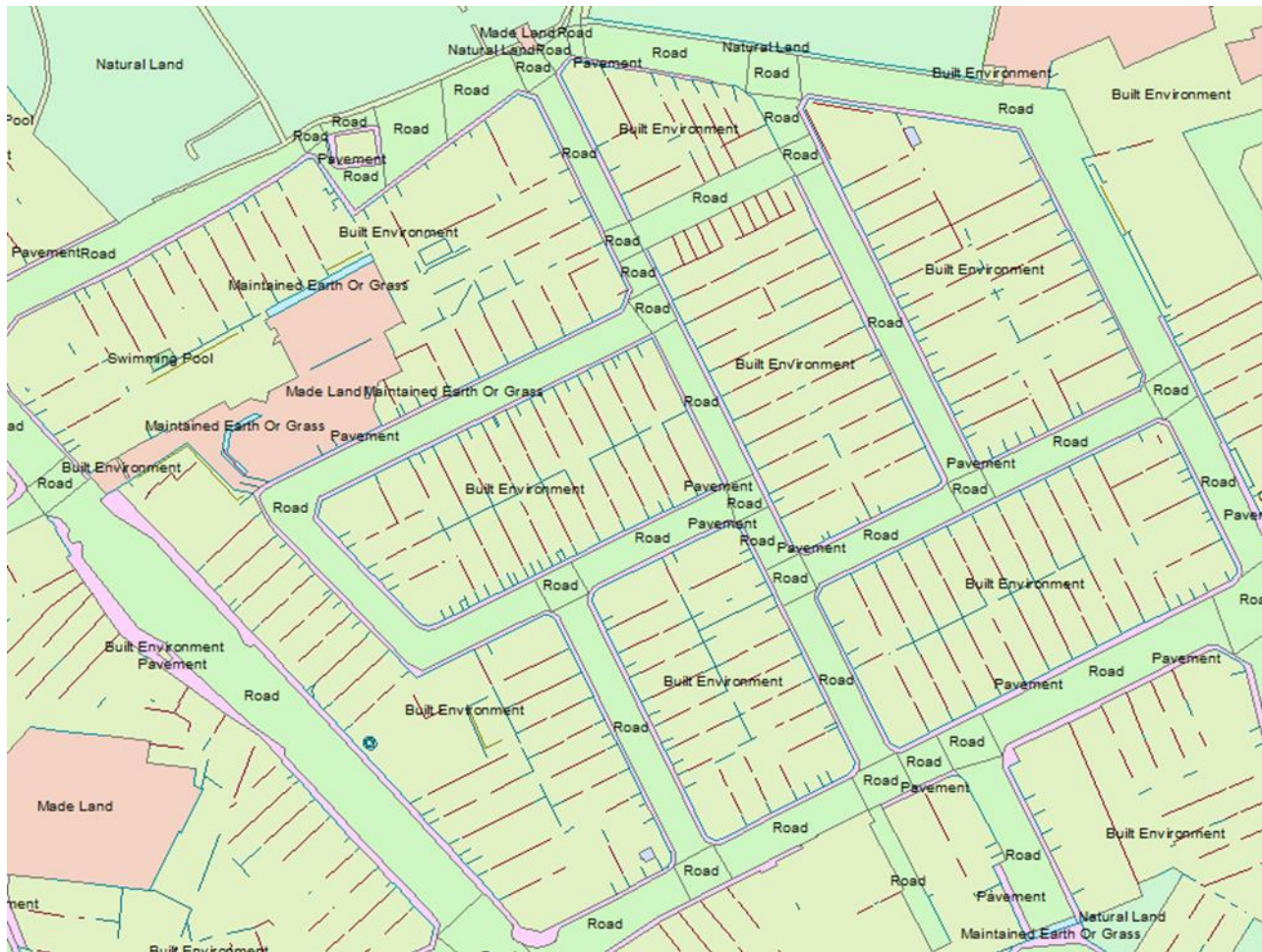
Polygonised Data Model

An object-oriented geospatial polygonised seamless data set of non-overlapping polygons that covers the whole of the Maltese Islands.

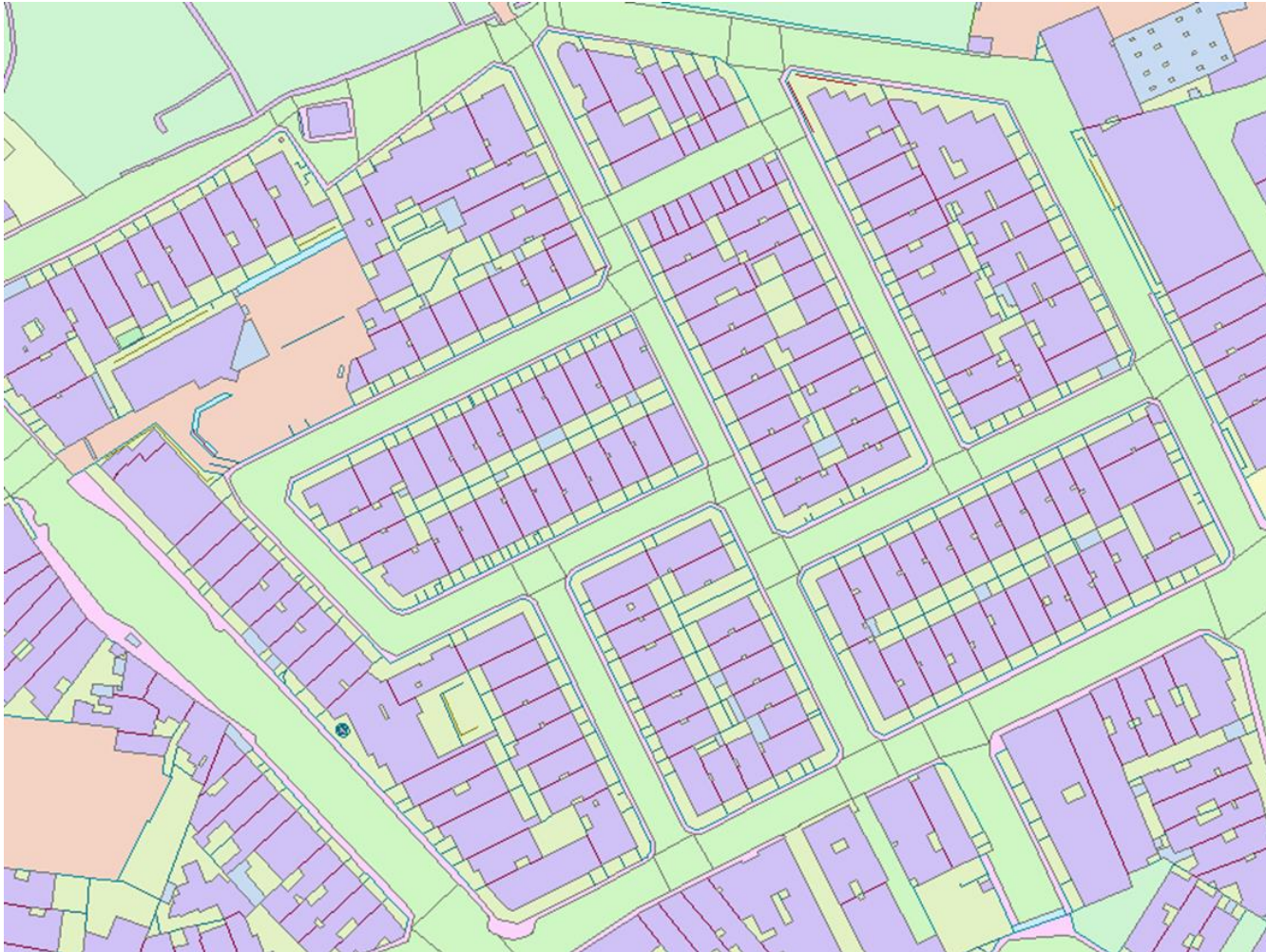
Themes classified into two main layers:
Ground surface Cover;
Overlaid Objects.

	+2
	+1
Earth Surface Cover Level	0
	-1
	-2

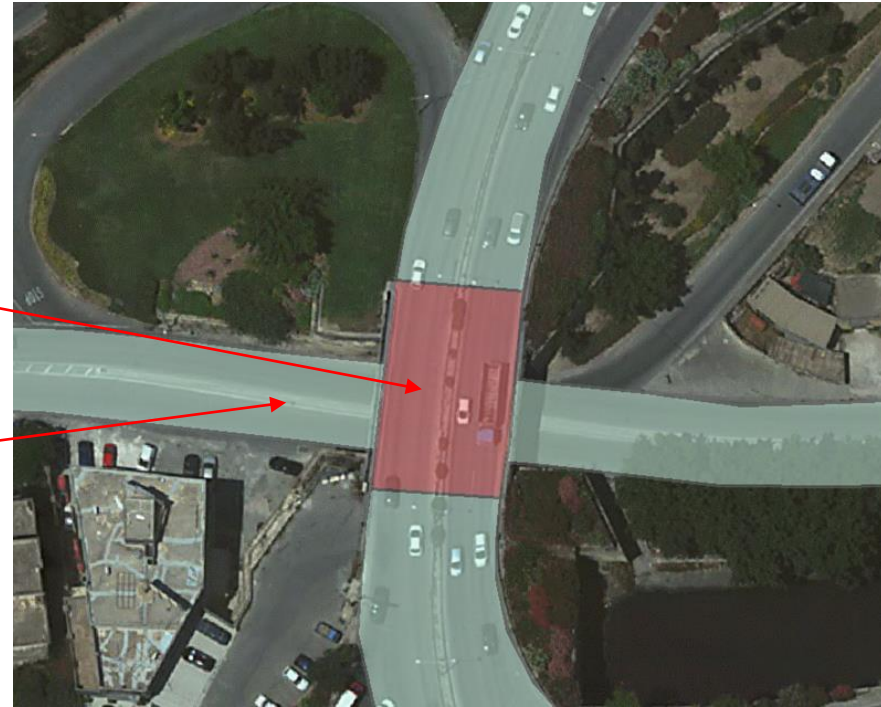
Ground Surface Cover



Overlaid Area



Ground Surface Cover



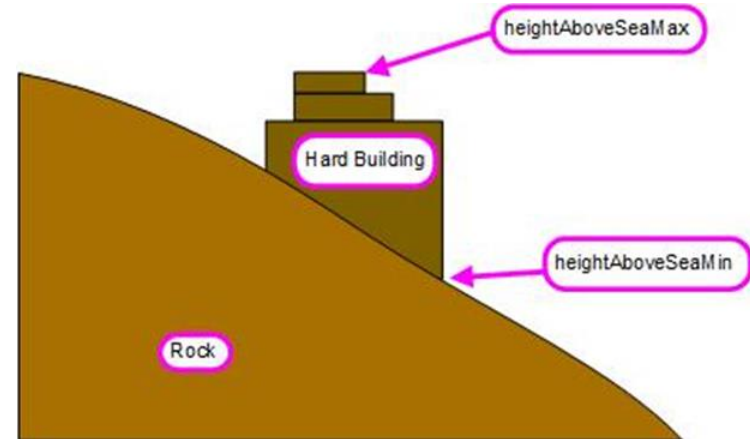
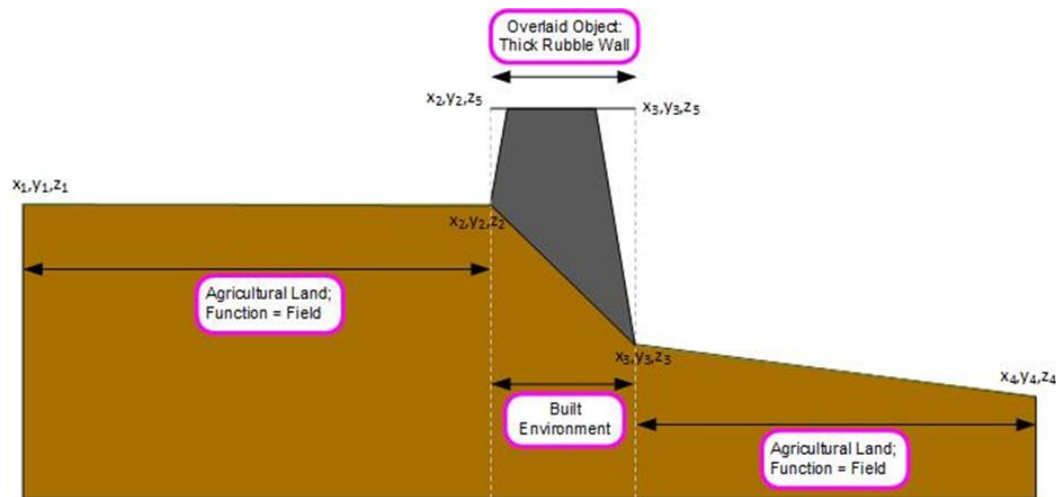
Images: Ordnance Survey Limited

Ground Surface Cover

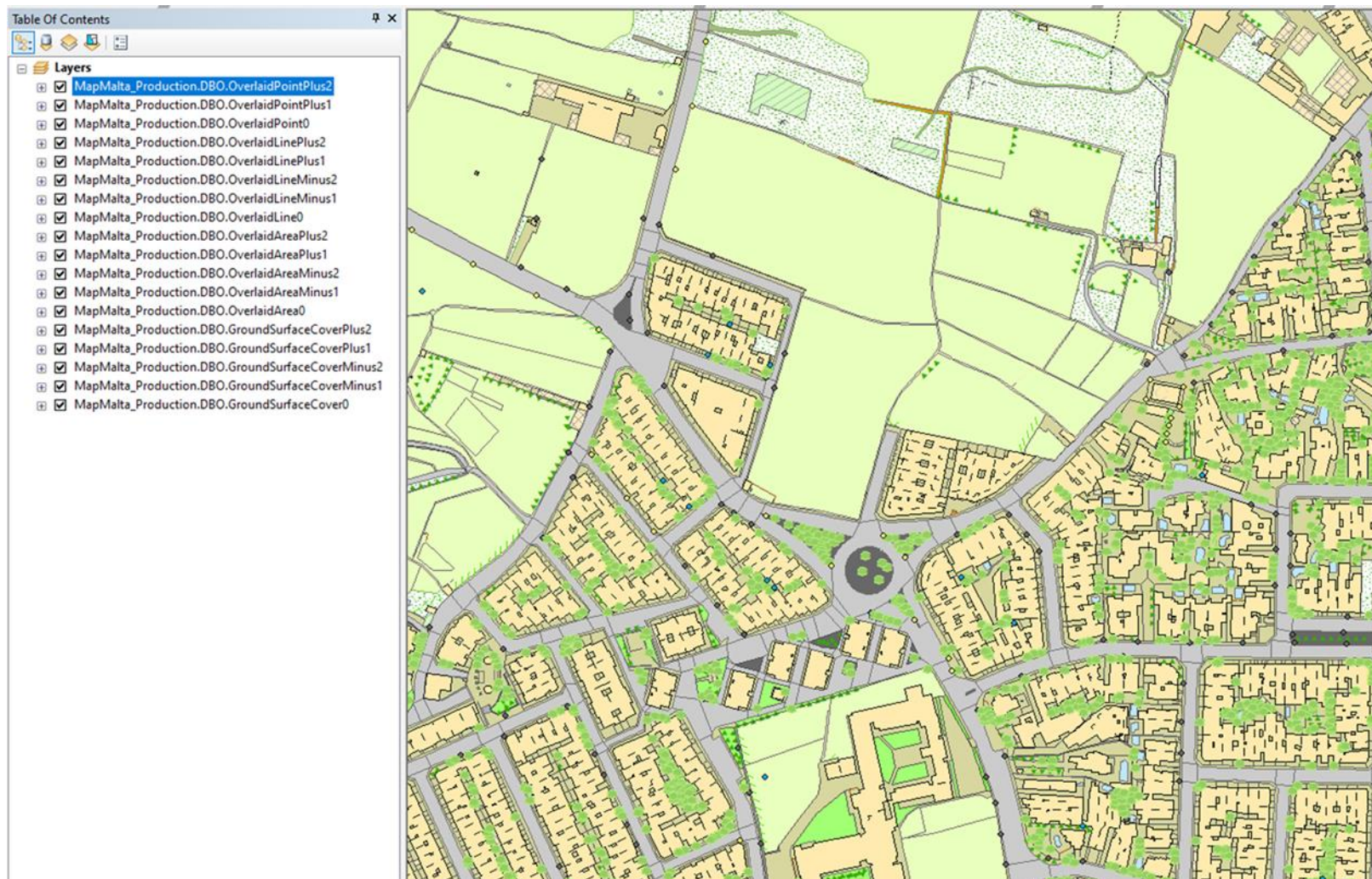


Images: Ordnance Survey Limited

Data Management



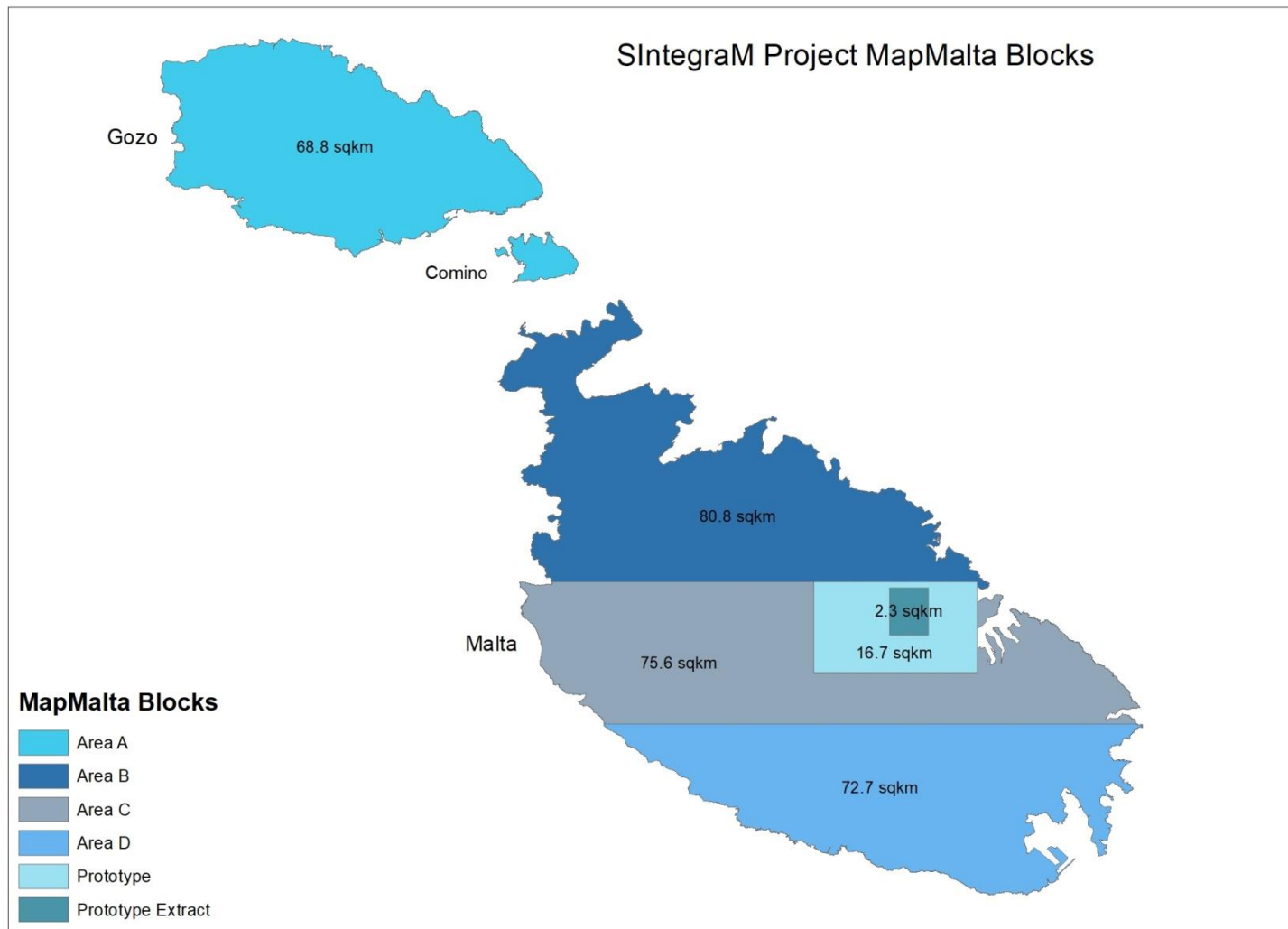
Images: Ordnance Survey Limited



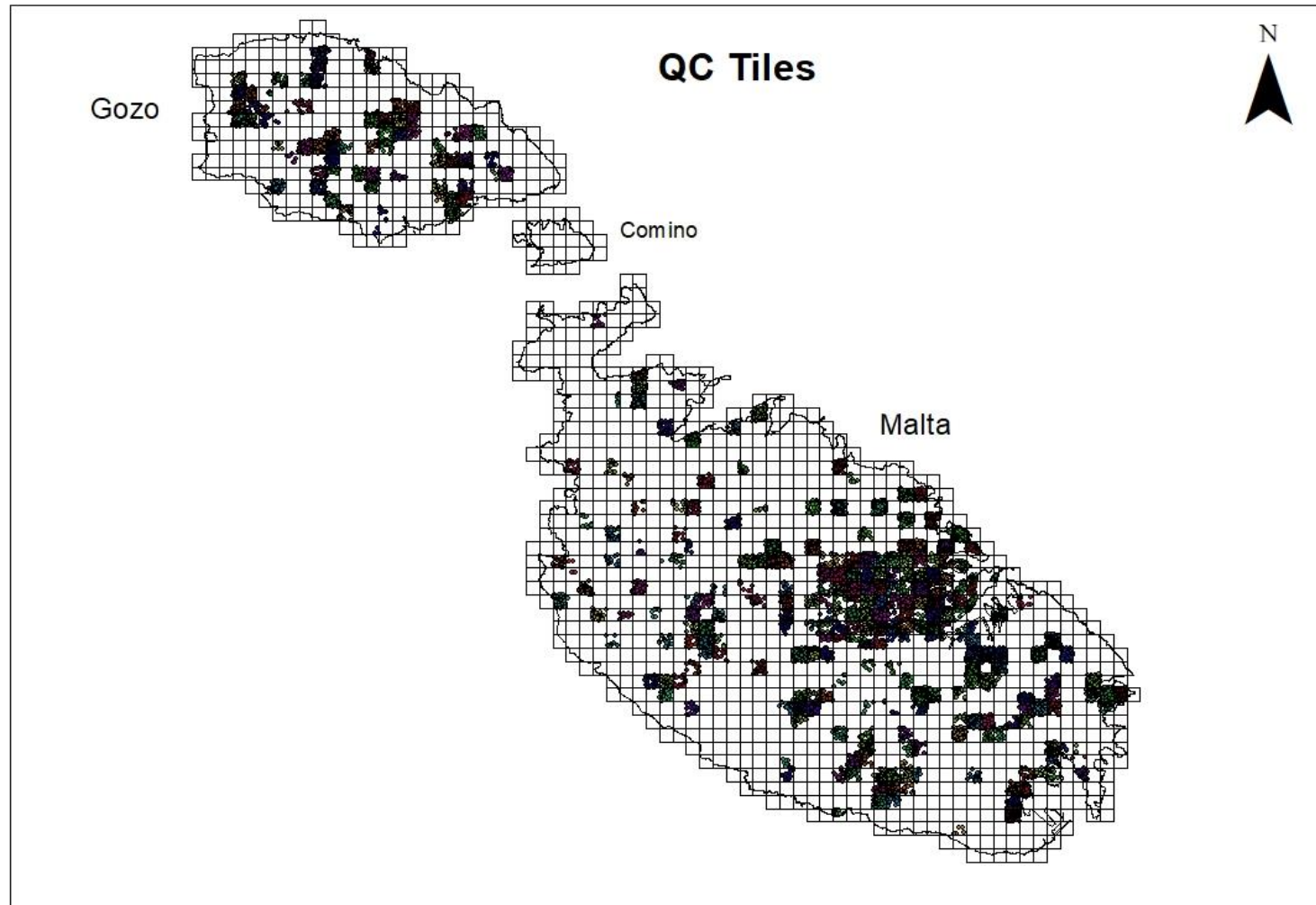
Specs Minor Modifications



MapMalta Blocks



MapMalta QC



Positional Accuracy – Geometric Fidelity : 99% when viewed at 1:500

The fidelity of data feature shapes and alignments to the shapes and alignments of the real world objects they represent, is fit for purpose for 99% of features attributed as Confident.

Positional Accuracy – Relative Accuracy : $< \pm 0.4\text{m}$

The measured distance between local data points (Data points no more than 500m apart), and the actual distance between the real world objects they represent, differs by less than the prescribed tolerance for 95% of local data points attributed as Confident.

Positional Accuracy – Absolute Accuracy : $< 0.25m$

The coordinates of a data point, and the true coordinates of the real world object it represents, differs by less than the prescribed tolerance for 95% of data points attributed as Confident.

Attribute Accuracy : 95%

95% of data features are free from errors of attribute accuracy (Are free from errors of classification accuracy where attributed as Confident).

Conceptual Consistency : 95%

95% of data features are free from errors of conceptual consistency.

Domain consistency : 100%

100% of data attributes are free from errors of domain consistency.

Topological consistency : 100%

100% of data features are free from errors of topological consistency.

Completeness : 95%

95% of individual 1km² tiles are complete (Are free from errors of omission or commission) when compared to the real world, as represented in the imagery from which the data was captured.

Accuracy

	Quality Measure	Method of Measuring
Relative accuracy	Urban: <0.4m relative error Accuracy is reported at 95% confidence interval	50 points in 0.5 km ² tile in a sample of 15 tiles semi-randomly selected
Positional accuracy	Urban: <0.25m Accuracy of position Accuracy is reported at 95% confidence interval	
Thematic (attribute) accuracy	95% of sample	Visual checks against ortho-images and on-site checks carried out on a sample of 32 km ² tiles (semi-randomly selected)

Accuracy

	Quality Measure	Method of Measuring
Logical consistency	100%	Automated tools based on agreed rules
Topological consistency	100%	Automated tools
Completeness	95% of sample	Visual checks against ortho-images and on-site checks carried out on a sample of 32 km ² tiles (semi-randomly selected)

Automated in-line measures (ESRI)

Automated off-line measures (FME)

Nonautomated measures (Manual inspection)

Topology Rules (ESRI)

ArcGIS® Geodatabase Topology Rules

Topology in ESRI® ArcGIS® allows you to model spatial relationships between features (classes) in a feature dataset. Topology is also used to define those relationships between features in a single feature class or subtype or between two feature classes or subtypes. Topology rules allow you to define the spatial relationships that meet the needs of your data model. Topology rules are violations of the rules that you can easily find and manage using the editing tools found in ArcMap®.



How to read these diagrams:



Topology rule name



Polygon

Must not overlap

Topology rules ensure that no two polygons overlap. The rule is violated when two polygons overlap.

Use this rule to ensure that no two polygons overlap. The rule is violated when two polygons overlap.

Polygon

Must not have gaps

Topology rules ensure that no two polygons have gaps. The rule is violated when two polygons have gaps.

Use this rule to ensure that no two polygons have gaps. The rule is violated when two polygons have gaps.

Line or Polygon

Must be larger than cluster tolerance

Topology rules ensure that no two lines or polygons are smaller than the cluster tolerance. The rule is violated when two lines or polygons are smaller than the cluster tolerance.

Use this rule to ensure that no two lines or polygons are smaller than the cluster tolerance. The rule is violated when two lines or polygons are smaller than the cluster tolerance.

Line

Must not have pseudonodes

Topology rules ensure that no two lines have pseudonodes. The rule is violated when two lines have pseudonodes.

Use this rule to ensure that no two lines have pseudonodes. The rule is violated when two lines have pseudonodes.

Polygon

Contains point

Topology rules ensure that no two polygons contain a point. The rule is violated when two polygons contain a point.

Use this rule to ensure that no two polygons contain a point. The rule is violated when two polygons contain a point.

Polygon

Contains one point

Topology rules ensure that no two polygons contain one point. The rule is violated when two polygons contain one point.

Use this rule to ensure that no two polygons contain one point. The rule is violated when two polygons contain one point.

Line

Must not have dangles

Topology rules ensure that no two lines have dangles. The rule is violated when two lines have dangles.

Use this rule to ensure that no two lines have dangles. The rule is violated when two lines have dangles.

Line

Must not self overlap

Topology rules ensure that no two lines self overlap. The rule is violated when two lines self overlap.

Use this rule to ensure that no two lines self overlap. The rule is violated when two lines self overlap.

Polygon

Must be covered by feature class

Topology rules ensure that no two polygons are not covered by a feature class. The rule is violated when two polygons are not covered by a feature class.

Use this rule to ensure that no two polygons are not covered by a feature class. The rule is violated when two polygons are not covered by a feature class.

Polygon

Boundary must be covered by

Topology rules ensure that no two polygons have a boundary that is not covered by a feature class. The rule is violated when two polygons have a boundary that is not covered by a feature class.

Use this rule to ensure that no two polygons have a boundary that is not covered by a feature class. The rule is violated when two polygons have a boundary that is not covered by a feature class.

Line

Must not overlap

Topology rules ensure that no two lines overlap. The rule is violated when two lines overlap.

Use this rule to ensure that no two lines overlap. The rule is violated when two lines overlap.

Line

Must not self intersect

Topology rules ensure that no two lines self intersect. The rule is violated when two lines self intersect.

Use this rule to ensure that no two lines self intersect. The rule is violated when two lines self intersect.

Polygon

Must not overlap with

Topology rules ensure that no two polygons overlap with a feature class. The rule is violated when two polygons overlap with a feature class.

Use this rule to ensure that no two polygons overlap with a feature class. The rule is violated when two polygons overlap with a feature class.

Polygon

Must be covered by

Topology rules ensure that no two polygons are not covered by a feature class. The rule is violated when two polygons are not covered by a feature class.

Use this rule to ensure that no two polygons are not covered by a feature class. The rule is violated when two polygons are not covered by a feature class.

Line

Must not intersect

Topology rules ensure that no two lines intersect. The rule is violated when two lines intersect.

Use this rule to ensure that no two lines intersect. The rule is violated when two lines intersect.

Line

Must be single part

Topology rules ensure that no two lines are not single part. The rule is violated when two lines are not single part.

Use this rule to ensure that no two lines are not single part. The rule is violated when two lines are not single part.



Off-line Measures (FME)

T8 : Overlaid Object features having Geometry *Polyline* at a given height level must not self intersect.

Topological Consistency. Mandatory Requirement. ESRI.

T9 : Overlaid Object features having Geometry *Polyline* at a given height level must not self overlap.

Topological Consistency. Mandatory Requirement. ESRI.

T10 : Overlaid Object features having Geometry *Polyline* must structure with any touching or intersecting Overlaid Object features having Theme *Division* at the same height level.

Topological Consistency. Mandatory Requirement. FME.

T11 : Overlaid Object features having Geometry *Polyline* at any height level must not have pseudo nodes except where the touching line features record different Type attribute values.

Topological Consistency. Mandatory Requirement. FME.

T12 : Polygon bounding Overlaid Object features* must be covered by a Ground Surface Cover polygon boundary at the same height level.

(* *Fence, Line Of Trees, Line Of Bushes, Line Of Prickly Pears, Thin Wall, Thin Rubble Wall*)

Topological Consistency. Mandatory Requirement. ESRI.

T13 : Non polygon bounding Overlaid Object features* must be contained by a boundary between adjacent Ground Surface Cover polygons at the same height level.

New Map New Data Model



More than just background mapping

A driver for efficiency and interoperability in the public sector

A stimulant for economic growth

Promote innovation in digital services



Developed to current industry best practice respecting international standards

Framework for efficient and timely maintenance and up dating

Feature lifecycle management compliant with European and international directives and standards

Thank You





EU funds for Malta | 2014 2020



Operational Programme I - European Structural and Investment Funds 2014-2020
"Fostering a competitive and sustainable economy to meet our challenges"
Project part-financed by the European Regional Development Fund
Co-financing rate: 80% European Union; 20% National Funds

