# Geographic referencing

Descriptions of process and data for geographic referencing of BIM

*Version: draft 1.0*

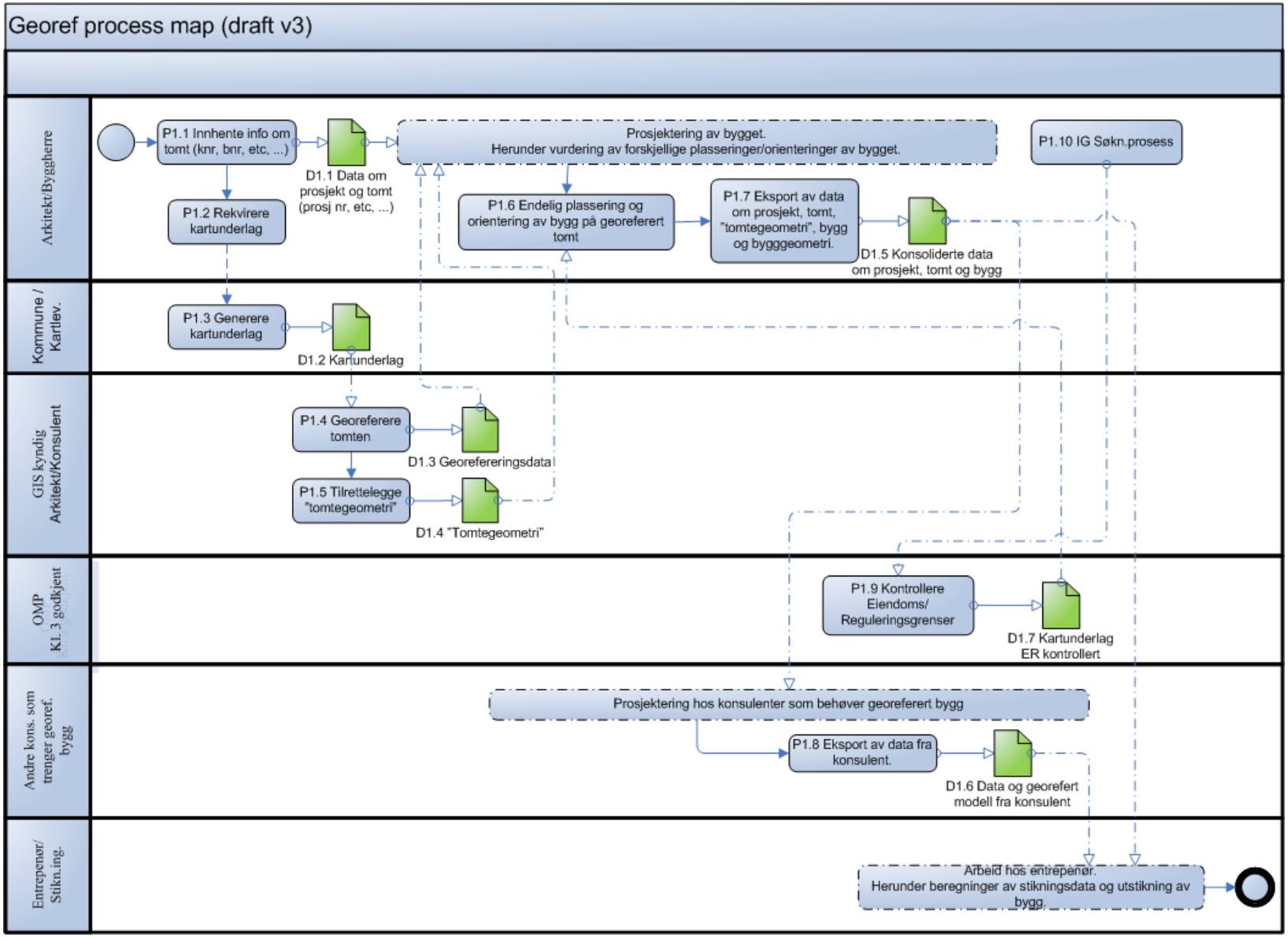
*Oslo, April 2010*

**Contents:**



See spreadsheet *on exchange requirements* for geographic referencing , ”20100415_ER_GeoRef.xls”.

## Process Map

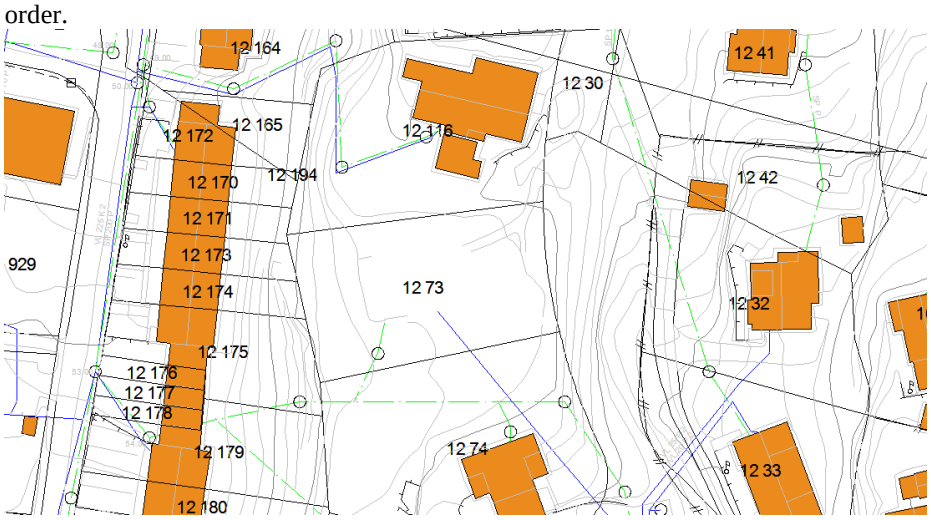

Georef process map (draft v3)
Arkitekt/Byggherre
Kommune / Kartlev.
GIS kyndig Arkitekt/Konsulent
OMP KL 3 godkjent
Andre kons. som trenger georef. bygg
Entrepenør/ Stikn.ing.
P1.1 Innhente info om tomt (knr, bnr, etc, ...)
D1.1 Data om prosjekt og tomt (prosj nr, etc, ...)
Prosjektering av bygget.
Herunder vurdering av forskjellige plasseringer/orienteringer av bygget.
P1.10 IG Søkn.prosess
P1.2 Rekvirere kartunderlag
P1.6 Endelig plassering og orientering av bygg på georeferert tomt
P1.7 Eksport av data om prosjekt, tomt, "tomtegeometri", bygg og bygggeometri.
D1.5 Konsoliderte data om prosjekt, tomt og bygg
P1.3 Generere kartunderlag
D1.2 Kartunderlag
P1.4 Georeferere tomten
D1.3 Georefereringsdata
P1.5 Tilrettelegge "tomtegeometri"
D1.4 "Tomtegeometri"
P1.9 Kontrollere Eiendoms/ Reguleringsgrenser
D1.7 Kartunderlag ER kontrollert
Prosjektering hos konsulenter som behøver georeferert bygg
P1.8 Eksport av data fra konsulent.
D1.6 Data og georefert modell fra konsulent
Arbeid hos entrepenør.
Herunder beregninger av stikningsdata og utstikning av bygg.

# SPECIFICATION OF PROCESS

## *P1.1 OBTAIN PROPERTY INFORMATION*

| | |
|---|---|
| Type | Process |
| Name | Obtain site information |
| Documentation | In the initial phase of the project, the architect and client (*byggherre*) must lay down some parameters that should not change during the project phase<br><br>• Project number and name<br>• Plot ID for the site (municipality / gnr / BNR / fnr)<br>• Site address<br><br>Note that if the construction area consists of several plot id's, one of these must be selected as a reference.<br><br>If the plot will later be separated from an existing plot, use plot id for existing plot.<br><br>These parameters should be written to an IFC file (D1.1) so that other players can take advantage of this |

## *P1.2 REQUISITIONED MAP SURFACE*

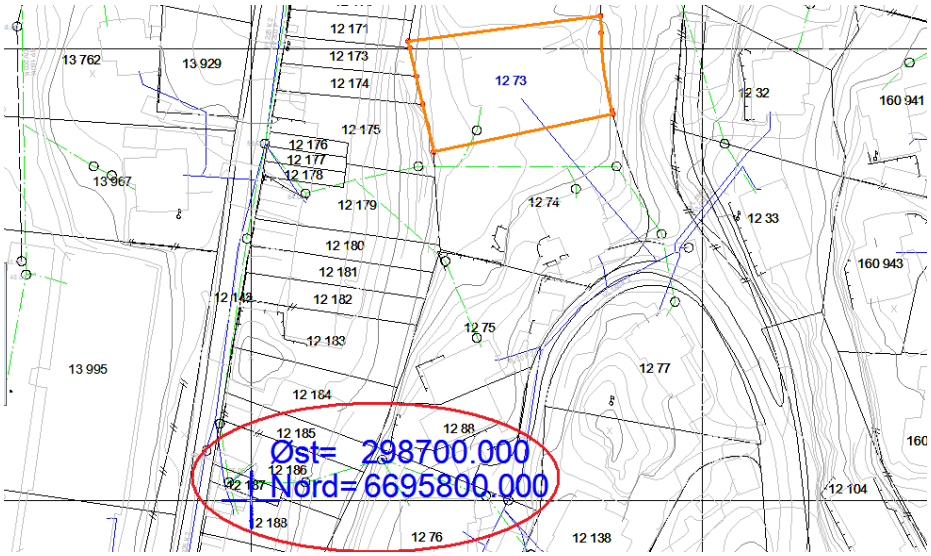
| | |
|---|---|
| Type | Process |
| Name | Require map surface |
| Documentation | In the initial phase of the project, the architect and builder contractor shall,must require surface map from the municipality or from other players, such as "Norwegian Property Information". Map size must be decided prior to order.<br>  <br><br>Requirements:<br>• The Map must be available as FKB data on SOSI format<br>• The coordinate system of the map must be without significant scale error and therefore requires that the map is provided on EUREF NTM<br><br>Note that if the supplier cannot deliver on EUREF NTM, it must be verified that the GIS expert architect / consultant has software that can transform the map to EUREF NTM. In this case it may be allowed to require the map on EUREF UTM. |

## *P1.3 GENERATING MAP SURFACE*

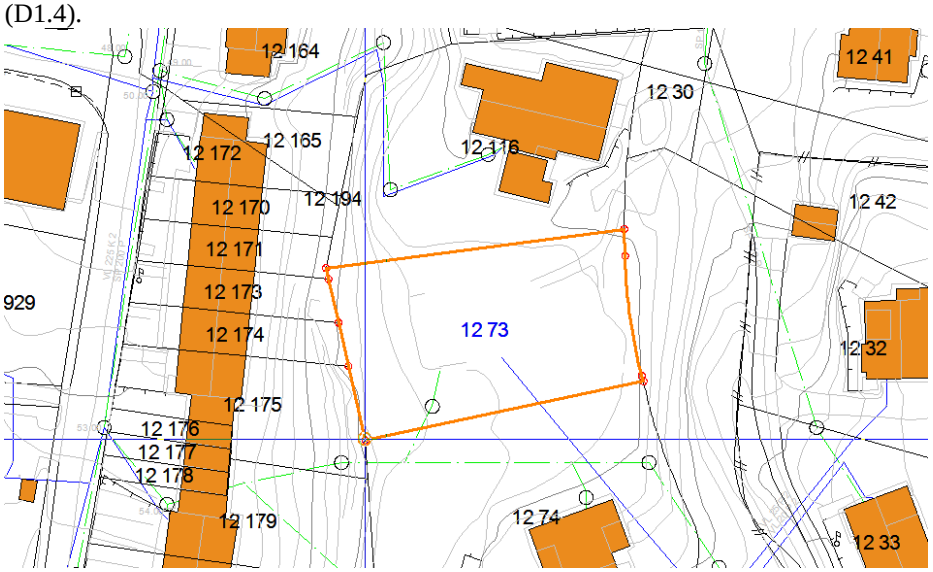
| | |
|---|---|
| Type | Process |
| Name | Generating map surface |

| | |
|---|---|
| Documentation | Municipal or other map provider must generate and send SOSI file as ordered by the requisitioner. |

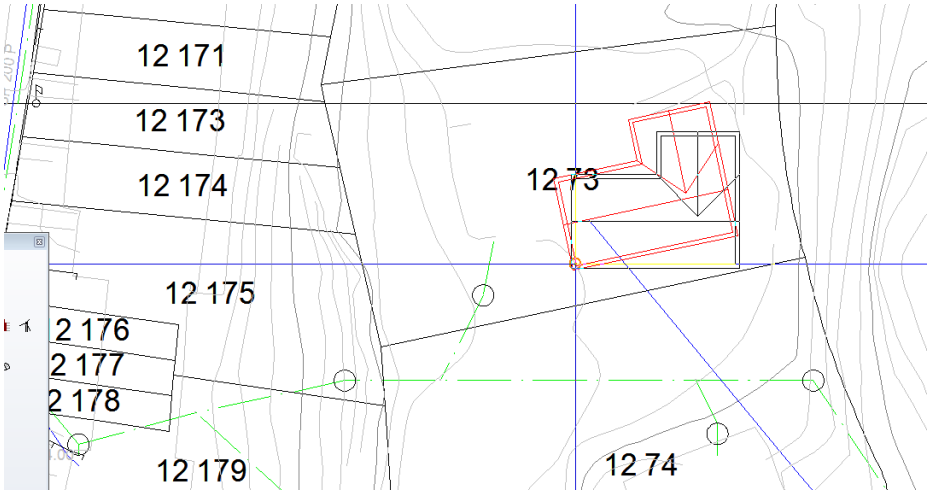
### *P1.4 PROPERTY GEOGRAPHIC REFERENCING*

| | |
|---|---|
| Type | Process |
| Name | Site geographic referencing |
| Documentation | The GIS expert architect or consultant does this.<br><br>One must have available software that can export the requisition map on SOSI format, as well as read the IFC file with the site and project parameters (D1.1).<br><br>The geographic referencing consist of a localizing the appropriate site in the map and selecting a geographic referencing point in the map grid located southwest of the site extent.<br>  <br><br>This point is used as a local origin of the plot (IfcSite) in the architect's BIM model. Location southwest of the site gives positive coordinates in the local coordinate system.<br><br>Note that the determination of origin does not lock the position of the building (s) (IfcBuilding) in the architect's BIM. Orientation of building (s) may change in the architectural model, relative to the site local origin.<br><br>It is important that the georeference height is determined correctly, so that all stakeholders in the project may relate to it. The height may well be the sea level (0.0), but this may be impractical if the site is located high above the sea level.<br><br>Information about the georeference and map Coordinate system properties is to be written back to an IFC file (D1.3) without destroying the land and project info (D1.1) |

## *P1.5 FACILITATE PROPERTY GEOMETRY*

| | |
|---|---|
| Type | Process |
| Name | Facilitate property geometry |
| Documentation | The GIS expert architect or consultant does this.<br><br>One must have available software that can read export the requisition map on SOSI format, as well as read IFC file georeference data (D1.3)<br><br>Adaptation consists of selecting the geometry of the appropriate site in the map, and transmitting it to the IFC file with blank geometry (D1.4)<br>(D1.4).<br>  <br><br>At the minimum, the geometry the site should be transferred, but the software should be able to support transmit of several types of map objects, such as construction limits, control limits, existing buildings or other variables (see D1.4).<br><br>The purpose of this process are the following:<br>1. The architect can relate to the map geometry when the building is placed in the local coordinate system for the site (ref P1.6).<br>2. Since the site geometry follows the lifecycle of IFC file, it will be possible for OMP (P1.9) to calibrate used land geometry against updated maps.<br><br>Site geometry is to be written back to an IFC file (D1.4) without destroying the land and project info (D1.1) or georeference info (D1.3) |

### P1.6 FINAL LOCATION AND ORIENTATION OF BUILDINGS ON GEOREFERT PROPERTY

| | |
|---|---|
| Type | Process |
| Name | Final location and orientation of buildings on georferenced property |
| Documentation | The architect does this.<br><br>One must have available software that can export IFC file georeferenced data (D1.3), and view this along with the projected building.<br><br>The position of the projected building consists of moving/rotating it in the site's local coordinate system so that the location is appropriate in relation to site geometry in D1.3.<br>  <br><br>Note! If the architect's software is also able to import/draw maps from SOSI format, one can obtain extra control that the site geometry and the georeference is properly executed. |

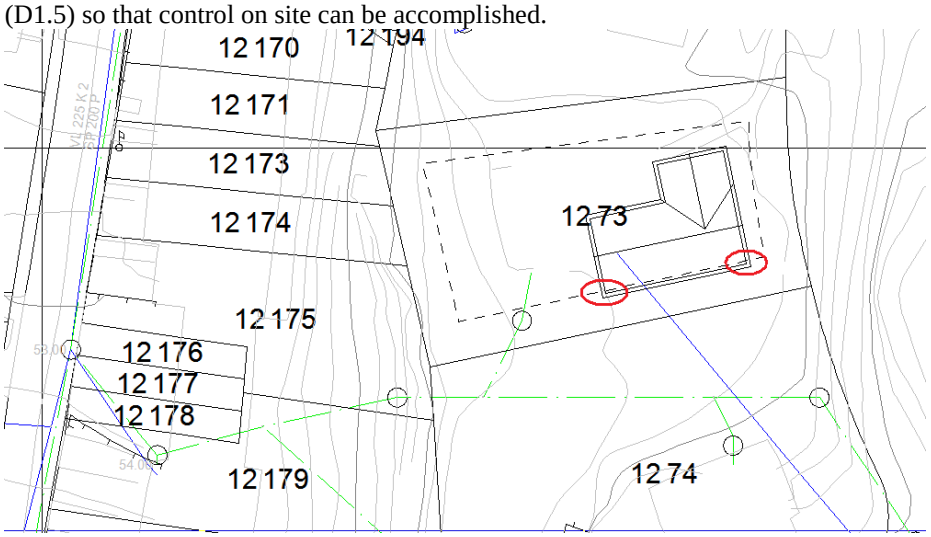
### P1.7 EXPORT OF DATA ABOUT THE PROJECT, PROPERTY, "PROPERTY GEOMETRY", CONSTRUCTION AND CONSTRUCTION GEOMETRY.

| | |
|---|---|
| Type | Process |
| Name | Export of data about the project, property, "property geometry", construction and construction geometry. |
| Documentation | The architect does this.<br><br>One must have available software that can export the building to an IFC file with georeferenced data (D1.3).<br><br>The building's geometry and the location of the site origin should be written back to an IFC file with consolidated data (D1.5) without destroying the land and project info (D1.1), georef info (D1.3), or the property geometry (D1 .4). |

### P1.8 EXPORT OF DATA FROM CONSULTANTS.

| | |
|---|---|
| Type | Process |
| Navn | Export of data from consultants. |
| Documentation | This is done by other consultants who make use of BIM models from the architect to enrich with new data of subjects. This may be electrical / HVAC contractors, (RIB structural model) or landscape architects.<br><br>One must have available software that can import the IFC file with consolidated data (D1.5), and compare this with their own data of subjects.<br><br>Your own data of subjects must could to be written back to an IFC file (D1.6) without destroying the building's geometry (BIM) and location of the local origin of the property (D1.5), property and project info (D1.1), georef info (D1 .3), or the property geometry (D1.4). |

## *P1.9 CONTROL PROPERTY / REGULATORY LIMITS*

| | |
|---|---|
| Type | Process |
| Navn | Control Property / Regulatory Limits |
| Dokumentasjon | This is done by other consultants who make use of BIM models from the architect to enrich with new subject data. This may be electrical/HVAC contractors, (RIB structural model) or landscape architects.<br><br>The control consists of acquiring updated property and regulation boundaries from municipality or other map supplier, and then to calibrate the building against these.<br><br>One must have available software that can import the IFC file with consolidated data (D1.5), and compare this with their own subject data. One should also have available software that can acquire NTM coordinates stabbing from the georeferenced building (D1.5) so that control on site can be accomplished.<br>  <br><br>If the location is not approved by the OMP, notification must be given to the architect, so that it can move / rotate the building in the local coordinate system (repetition of P1.6). In particularly serious conflicts, this may in the worst case lead to changes in the actual building project.<br><br>It is also desirable (but not a requirement), the OMP should be able to enrich the IFC file with the updated geometry and land ownership / control limits, if these are changed. The property geometry should be written back to an IFC file (D1.7) without destroying the land and project info (D1.1) or georef info (D1.3) |

## *P1.10 IG APPLICATON PROCESS*

| | |
|---|---|
| Type | Process |
| Name | IG application process |
| Documentation | This is done by the architect / client.<br><br>Application for IG (starting permission) can occur long after both the georeferecing and the building design is finished.<br><br>PBL requires the age and quality of the used property and regulatory boundaries. Therefore, an application for the IG must ensure that the placement of the building is appropriate through the use of an OMP.<br><br>This process therefore requires an approval from the OMP via the process P1.9. |

# Specification of Data

## *D1.1 DATA ABOUT THE PROJECT AND PROPERY*

### D1.1.1 Data about the project and property -- contents

The architect or builder about the project and site must record the following data:

| Designation | Description | Binding to the IFC |
|---|---|---|
| Project Number | Shared unique project identification (ID) for all players. NB! All players must use 100% identical spelling | IfcProject.Name |
| Prosject Name | Name for or short description of project common for all actors. | IfcProject.LongName |
| Development The site identification (ID) | Unique identification (ID) for the site to be designed. As unique identifiers used Plot <Number, comprising:<br>"QNA Gnr BNR Fnr SNR"<br>The format should **always** follow this layout: "QNA Gnr BNR Fnr SNR" where local number always has four digits with possible leading zeros. Gnr, BNR, Fnr and SNR must **not** have leading zeros. All fields must be included. Fields that are not in use should be defined with 0 (zero). The fields are separated by white space. Do not use characters other than space and numbers.<br>Examples:<br>"0904 200 2430 0:14 (Fnr is unused)<br>"0904 200 2430 1:00 (SNR is unused)<br>"0904 200 2430 0:00 (Fnr and SNR are unused)<br><br>ID used for the main plot where the development site consists of several street addresses/building numbers, | IfcSite.LandTitleNumber |
| Development Site Adress | Address for the projected site. | IfcSite.SiteAddress |

### D1.1.2 Data on the project and property - Storage location

These data should at this stage in the project saved:

- In the project's BIM manual
- In the project management tools with an architect, builder and any joint project tools.
  Examples of project management tools can be architect BIM system, document management system, model server, dedicated project management, etc.

### D1.1.3 Data on project site - Transmission format

This data can at this stage of the project be transferred between applications:

- Manual using "cut'n'paste".
- Use of IFC if the program that creates the project is different from the architect's BIM system.
  Both the IFC version 2x3 and 2x4 can transfer these data.

## *D1.2 MAP SURFACE*

### D1.2.1 Map surface -- Content

- Map data

  Including ownership and control limits (Note: entails half-year validity, and must be confirmed later in the process should the validity period be exceeded before the starting permission application)
- Should be ordered NTM

### D1.2.2 Map Surface -- Storage Location

Map surface should be saved at this stage in the project:

- With GIS expert architect / consultant in the GIS system.

### D1.2.3 Map Surface -- Transmission Format

Map surface transmitted by SOSI.

## *D1.3 GEOGRAPHIC REFERENCING DATA*

### D1.3.1 Geographic referencing data -- contents

Geographic referencing data describe the site locations in the maps, such as coordinate system, datum, height system, the origin of the plot, etc. For details about geographic referencing data, see spreadsheet with detailed description of Exchange Requirements.

### D1.3.2 Geographic referencing data - Storage Location

These data should at this stage in the project be saved:

- In the project's BIM manual (prose)
- The GIS tool for GIS-trained architect or consultant
- In the architect's BIM system
- Joint project tools, for example the model server

### D1.3.3 Geographic referencing data - Transmission Format

This data can at this stage of the project be transferred between applications:

- Manually using "cut'n'paste".
- The IFC Version 2x4. Can not be transferred through the 2x3 without using non-standard extensions (property sets).

## *D1.4 PROPERTY GEOMETRY*

### D1.4.1 Property geometry -- contents

Property geometry must contain:

- Property borders (have no height, set a standard height; IfcSite origin Z)

Property geometry can also contain:

- Legal limits
- Origo/axis symbols
- Checkpoints
- Construction limits
- Regulatory info
- Existing/ adjacent building that will remain
- Tarrain
- El, HVAC infrastructure

SOSI 4 encodings must be used.

Further descriptions can be found under Site Geometry and Representation Geographic element spreadsheet GeoRef Exchange Requirements.

### D1.4.2 Property geometry -- Storage Location

These data should at this stage in the project saved in:

- The GIS tool for GIS-trained architect or consultant
- In the architects BiM-system.
- Joint project tools, for example the model server.

### D1.4.3 Property Geometry - Transmission Format

This data can at this stage of the project be transferred from the GIS expert architect or the consultant's GIS application to the Architect's BIM application:

- Through the IFC. Supported by both the 2x3 and 2x4.

IFC2x4 has better support for geographic elements.

## *D1.5 CONSOLIDATED DATA ABOUT THE PROJECT, SITE AND BUILD*

### D1.5.1 Consolidated data about the project, property and buildings - Content

The following consolidated data about the project, property and buildings created by architect:

- D1.1 Data on projects and property.
- D1.3 Geographic referencing data
- D1.4 Property geometry
- Build Model (BIM), located on the site
    - The architect should know where the origin (X = 0 Y = 0 Z = 0) is in the building.

Comment: need convention for where the Z = 0 is in the building.

### D1.5.2 Consolidated data about the project, property and buildings - Storage Location

These data should at this stage in the project be stored in:

- Joint project tools, for example the model server.

### D1.5.3 Consolidated data about the project, property and buildings - Transmission Format

This data can at this stage in the project be transferred from architect to contractor and consultants with:

- Build Model (BIM), located on the site, D1.1 and D1.4 through IFC 2x3 or 2x4.
- D1.3 The IFC 2x4 or "manually" via BIM-manual.

## *D1.6 GEOREFERNCED MODEL FROM CONSULTANTS*

### D1.6.1 Georeferenced model from consultant - Content

Georefernced model from the consultant:

- Build Model (BIM) with the consultant's amendments placed on the site.

### D1.6.2 Georeferenced model from consultant - Storage Location

These data should at this stage in the project are stored in:

- Consultant BIM system
- Joint project tools, eg the model server.

### D1.6.3 Georeferenced model from consultant - Transmission Format

This data can at this stage of the project be transferred from the consultant to the contractor and architect with:

- The IFC 2x3 or 2x4.

## *D1.7 MAP BASIS ER-CONTROLLED*

### D1.7.1 Map data ER-controlled - Content

Map basis as provided in D1.2 will contain updated Real Estate and Regulatory Limits (ER). These limits must be checked / verified as part of the process before one may apply for starting license, as ownership and control limits have a validity of six months.

- Controlled property boundaries
- Controlled regulation limits

History and information about the map base is ER-controlled. Is it possible to put this in the IFC in a suitable place? New map data must be obtained from any municipality – in case of changes

### D1.7.2 Map data ER-controlled - Storage Location

ER-controlled base map should at this stage in the project be saved:

- In OMP in GIS system

### D1.7.3 Map data ER-controlled - Transmission Format

IS-controlled base maps are transferred via the SOSI.