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AN ATTEMPT OF THE METADATA STANDARD CREATION FOR THE TECHNOLOGY OF MOBILE LASER SCANNING IN POLAND

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ABSTRACT: Authors of the paper are presenting the attempt of the metadata standard creation for the technology of Mobile Laser Scanning. The research leading to the result presented in the publication was based on practical aspects of works realized within the usage of Mobile Laser Scanning measurements on the territory of Poland and theoretical issues concerned at Warsaw University of Technology in the area of metadata and standard creation. Usage of Mobile Laser Scanning gives the great advantage of acquisition impressive sets of data in short period of time finding their potential in the fields heritage preservation, architecture, deformation monitoring and industrial applications. In relation to the variety of applications and elements which needs to be concerned as the crucial parts of data sets like precise characteristic of the quality of acquired data authors attempt to create a metadata standard enabling potential prioritization and selection of data into normative which could in the future became a basis for regular normative creation considering this sort of measurements. Until now no sort of Laser Scanning tools has received its own standard despite the fact it is getting more and more necessary also by the fact of its growing popularization and variety of usage in different fields of life.

INTRODUCTION

Few years of authors efforts in suggesting realization (technical) standard for the process of inventarization of architectural objects, general building and heritage constructions has ended with establishing so called end product matrix. This product, characterized as a synergy of three commonly connected parameters (S- semantic, D-precision, Q –quality). As the base for its creation is being used young, and still developing technology of terrestrial laser scanning, which is slowly replacing other measurement technologies being used until now (for example photogrammetry technology) for core data collection in (x, y, z) spatial coordinates format.

In several publication of the authors (Falkowski et al.2010[a], Falkowski et al. 2010[b],) a need of existing Polish technical instruction (G 3.4) describing already mentioned inventarization process, replacement by the new document was given. The authors noticed in conclusion that the quest of standardization of inventarization process is only a margine of highly complexed issue – which is standardization of the whole technology of laser scanning covering ALS-aerial laser scanning, TLS- terrestrial laser scanning, MLS- mobile laser scanning, and direct context of its usage - which is a result born by specific

collections of created data, describing surrounding and extrapolated out of it in post processing end products.

Therefore, the key suggestion published in this article is a suggestion for creation of general standard for laser scanning technology with a possibility of its formal notification so that its effects could be used properly in general scope – governmental and public, to realize it, we need:

1. To characterize for certain methods all of technical parameters describing their specifics covering inter alia type of used scanning devices,
2. To determine the methods, and possibilities of their certification and calibration,
3. To define and characterize types and parameters of measured data sets which are being created by their meands (x, y, z coordinated of point clouds),
4. To define a method for georeferencing of point clouds as much as used tools, applications (including algorithms) implemented in the process of post processing,
5. To define a outlook of the end product, which is being create by the usage of each of these methods including their characteristics,
6. To define the method for notification of all data mentioned above,
7. To define and establish the notification of universal spatial data exchange formats for lately
8. created x, y, z point clouds and products generated out of them,
9. To define the method for their identification in the process of archive and collecting spatial data.

As it can be easily noticed – in the last standarization link suggested by the authors, a new idea is hidden – to describe, all of the products and sets created in the technological process of laser scanning, by defined in EU standards for spatial data notation metadata and rules for their implementation in created in Europe Spatial Data Infrastructure (INSPIRE).

1. ACTUAL TRENDS ACROSS EUROPE IN TERMS OF METADATA STRUCTURE CREATION

For better understanding of covered topic, it is necessary to clarify and explain series of definitions and concepts which became the base of this publication. Starting in accordance to hierarchy it is important to begin with metadata idea, which is need to be emphasized that in relation to European Commission regulation metadata are the data about the data. They consist of information about spatial data collections (layers, databases and so on), especially in the field of fast and effective searching for data which is in the interest of potential customer. Metadata are also playing an important role in country and European spatial information infrastructure- INSPIRE construction. This Directive oblige countries who belong to European community a duty for meta data creation, which should cover the aspects of spatial data collections in certain mentioned in it branches. Creation of metadata demand plenty of geomatic standards involvement, which are defined in proper ISO norms. For metadata creation it is possible to use special editors, which are nothing else than dedicated applications, which covers relative standards and keep the maintance of metadata profiles.

As we noticed the metadata terminology is directly connected with INSPIRE Directive. To understand in proper and complex way the idea there is need to take a closer look at the

specifics of Directive itself. Following the definition given by **Geoportal.gov.pl,** the INSPIRE Directive (Infrastructure fo r Spatial Information in Europe) is a set of law, organizational and technical issues connected with services offering public access to spatial data on the territory of EU. INSPIRE basis on the spiral data infrastructure of member countries. The goal of Directive implementation is to simplify and accelerate access to data as much as improvement of capabilities of their comparison within the usage inside the European community.

Until now the collection of proper spatial information relating to particular issue was very time and cost effective. However comparisons of these data in borders of different EU countries was almost impossible because they weren't integrated (harmonized). Standardization which is the key point of the publication in the opinion of the authors makes it much easier, under condition that the laser scanning technology usage creating a set of different end products will get defined by proper set of describing them metadata information.

The idea of metadata is systemized and presented in the best way by Professor Elżbieta Bielecka in Her „Rules for metadata implementation in INSPIRE" (Bielecka, 2007) suggesting that the background of INSPIRE Directive is related mainly to spatial data collected by public organs (or in their name) and to use them by the same organs during public processes realization. Nevertheless if necessary it is also possible to implement the same rule for spatial data collection for private or legal representatives different than public organs (in this category nowadays laser scanning technology is being settled). In the opinion of Professor Bielecka metadata are also connected with the demands for further usage of spatial data. INSPIRE Directive puts the demand that particular spatial data collections after combination should create a new coherent set, however the process of combining them should be realized automatically. Though it is necessary to create metadata but also to prepare set of regulations determining technical solutions assuring interoperability and harmonization of spatial data sets and services for the area lying in our interest.

Analyzing these issues the authors want to indicato that in „Commission regulation (WE) NR 1205/2008 from 3 Dec 2008. in case of 2007/2/WE directive realization of European Parliament and Board in the field of metadata" (Regulation, 2008) in point (1) there is purpose for metadata creation defined like also the definition of metadata:

"Directive 2007/2/WE defines general rules for spatial information infrastructure creation in European Community. According to the fact that for proper existence and functioning of this infrastructure it is necessary that the user should be able to find spatial data sets and spatial data services and to determine if they can be used and in which purpose, community members should open the access for these collections and services in the form of metadata. Because this kind of metadata should be compatible and possible to be used in the community and trans border context, it is necessary to define rules for metadata being used for describing the sets of spatial data and services related to the topics mentioned in attachments I,II,III to directive 2007/2/WE.". In §3 European Commission Regulation (KE) says that: „Metadata describing collection of spatial data, series of spatial data sets or spatial data Services covers the elements from metadata group determined in part B of the attachment and are created and archive according to rules précised in parts C and D of the attachment.". Conclusion coming out of it is simple – metadata are describing

sets, series of sets and services. On this basis we consider, that metadata can be divided on separate types describing:

1. Collections, set of collections, services,
2. Particular types of data, or sometimes particular data,
3. Technology used for data collection and/or used for post processing the core data to end result.

For type 1 metadata we can subordinate the whole topic covering the identification of the collection (Rozporządzenie,2008), which is: name, type, language, address and ID of set. To the second type we can subject metadata describing certain data for example metadata for evidence parcels (Wytyczne,2010), which are the element of spatial information infrastructure, and on the other hand they are one of the kind of spatial data. To third type it is possible to subordinate partly one of the points treating about quality and importance (Regulation, 2008), covering the issue of history and process of collection creation, under condition, that issues related to collection technology or post processing the data are going to be placed there.

The issue of metadata describing set of metadata related to particular data division is often not simple and clear. Metadata describing accuracy should be considered as metadata of collection or metadata of data settled in the collection? Metadata covering actual data are related to data or collection? We consider that examples of metadata shown above describes as much collections as the data, but it is possible to divide them: if for example some particular element of metadata describes the accuracy of data, the only factor (without division into separate kinds of data) is the element describing the collection, however if the situation when description of accuracy would relate to chosen (not all of them) data in the collection would happen – than such element of metadata would become as the one which describes the data. In other topics of metadata covered by Regulation of European Commission it is impossible to find any relations to the technology. However pure definition answering what are metadata and what they describe suggest, that the technology description in context of metadata is really interesting for EC. Nevertheless we suggest that metadata collection should be extended with some elements related to source data acquisition and technology of post processing realization. It is in direct relation with "new" technologies, like for example laser scanning, which are getting more and more popular, and are still not equipped with standards covering such issues like certification, calibration or technical issues describing conditions of certain method usage. Mentioned laser scanning is a such concept, and we will try to suggest in the publication few elements of metadata related to this technology.

2. CHARACTERISTICS OF LASER SCANNING AND GENERATED PRODUCTS PARAMETERS AS A BASICS FOR METADATA CREATION

The basic issue, which is related to considerations over standardization of documents created as a result of laser scanning technology usage is establishing the set of methods used for data collection, way of their post processing and designation of their end product. The authors in this publication suggests that in the background of any analysis way of description and notification of information related to all of the above elements should be considered. Therefore the easiest and most proper solution should be defining the metadata

describing as much parameters of equipment used for information collection like also the structure of data itself gained in the process of measurement which in the next step will be used for post processing and analysis, becoming a new basis for the end product. Suggested division covers three separate but directly connected with themselves groups representative for the definition of laser scanning, which contains TLS- terrestrial laser scanning, MLS- mobile laser scanning and LIDAR- aerial laser scanning. For each of mentioned technologies authors suggest to prepare a short ordination of used equipment, types of registeres data and realized documents which are describing the end products being a result of usage of certain technology. Ordination suggested by the authors covers such issues like:

1. Specifics of equipment used for data collection;
2. Structure and specification of registered point cloud;
3. Size and density of point cloud;
4. Purpose of data set (point cloud) creation ;
5. Format of data notfication;
6. Type of chosen georeference;
7. Type of the scanner;
8. Resolution;
9. Certification and calibration of used pieces of equipment;
10. Type and characteristics of post processing;
11. Specified data exchange format;
12. Type of end product.

An important issue in such ordination like the one presented above, is consideration of worldwide works and tendencies over standardization or unification in accordance to ISO norms related to questions connected with certain sectors (TLS, LIDAR, MLS), which by the recommendation of authors should be also considered in relation with presented proposal.

2.1 Terrestrial laser scanning TLS

Terrestrial laser scanning TLS is the new technology of survey which is using laser scanner. The operation of laser scanner is based on sending the laser beam and registering its reflection in phase shift way or impulse way in accordance to the type and kind of a scanner. After reflection the beam comes back to the scanner and brings the information about the intensity of the reflection from certain surface, by its usage we are able to measure also the angle and distance to scanned object.
Laser scanner is the device containing of several elements:

- Laser rangefinder;
- Set of mirrors directing the laser beam in different directions;

Thanks to scanner measurements we get so called point cloud, which is a collection of points with XYZ coordinated showing a three dimensional model of measured object.

- Point cloud is characterized by its high density, usually exceeding 10 pkt/cm^2;
- Speed of survey depends on the type of the scanner. Usually it is 250 000 pkt/s, which gives us a possibility to register a model from one stand in just few minutes;
- Accuracy of survey varies between 2 – 15 mm Precision depends from the type of the scanner and method of survey;

- Despite the coordinates also so called intensity image is being registered – which is black and white photo taken by the detector of the laser. Photo is characterized by high resolution and great radiometric quality – registration with 16bit/pixel.

Products gained as the result of TLS survey:

- Point cloud with XYZ coordinates;
- Intensity image and collection of survey photos;

TLS measurements are being made to get high precision three dimensional model of scanned object. Model itself is already a great material for measurements and analysis realization. For the needs of the users laser scanning technology enables us to deliver certain set of end products:

- Three dimensional models presented as point clouds. Such models are being created by combination of several point clouds into one whole product. Models enables us to realize measurements, generate sections and visualizations of the objects;
- Inventory drawings. Views, sections and visualizations realized on the basis of registered point clouds are characterized by high accuracy, and relatively high range of details;
- Three dimensional, vector building models, industrial construction and engineering objects;
- Measurements and object models with unusual shapes (including "reverse engineering"), deformation analysis.

Products realized on the basis of data gained by the means of terrestrial laser scanner are being implemented in preparation of BIM documentation (Building Information Modelling – documentation which role is to get the data about buildings for the needs of their proper management) and STEP (Standard for the Exchange of Product Data – documentation which enables interoperability of data between different systems. BIM like also STEP are characterized by the fact that for their usage we need metadata, so we face the demand of laser scanning data delivery not in the raw format, but equipped with additional systematic information. Until today no ISO standard has been written which would cover the aspects of terrestrial laser scanning, it is officially confirmed by David Barber publication „Towards a standard specification for terrestrial laser scanning of cultural heritage". Authors by this fact deeply emphasize a need for proper standard creation as much as for the set of normative which would be able to precisely define in the future this methodology as much as data formats necessary for the usage of this technology for production purposes.

2.2 Mobile laser scanning MLS

The name for mobile laser scanning MLS relates to the technology of survey which allows us to register, by the means of moving vehicle, a point cloud with XYZ coordinates information oriented in geodetical spatial reference system.

MLS platform consists of certain elements, which in the opinion of authors should be fully characterized by the method of metadata creation:

- Type of the vehicle: car, platform, moving platform, coach, boat;
- Type of the scanner, or group of scanners working in the profile setting – scanners measures profiles in vertical surface. Combined with forward movement of the vehicle registered profiles gives us a three dimensional point cloud;

- Type of inertial navigation system (INS) – consisted of gyroscopes and accelerometers and tilt meters which enables us to define movements and shakes of the vehicle;
- Type of the GPS receiver working in KINEMATIC function, which supports the INS system workflow;
- Type of the data registration unit;
- Type of the registration cameras set, which enables us to realize photogrammetric stereoscope measurements. Cameras realize photos in short periods of time, by which they assure constant registration of the measured object;
- Type of chosen data exchange and archive format enabling full interoperability with systems like CAD or universal ones like LAS, PTS or PTC;
- Chosen and define proper level of density of registered information in relation to the level of details of realized project documentation;
- Definition of georeferencing type, enabling to orientate registered point clouds in proper reference system or local coordinate system, in which further works are going to be continued;
- Usage of proper certificates determining the quality of documentation like also rectification of used equipment consisting of scanners or GPS antens.

Important issue is the fact that proper schematization of used equipment, defining their technical parameters in the way which enables them to be used again for further works and result analysis basing on the measurement should be respected.
As a result the full description of data achieved in the MLS measurement realization:

- Point Cloud with XYZ coordinates. Point cloud in many cases is supplemented by the information of colors of measured objects. Point clouds are characterized by high level of density from 50 to more less 5 000 points per 1 m^2 and different accuracy of coordinates determination: from few meters up to 1 cm in accordance to exterior geodetic net;
- Collection of survey photos;

MLS measurements are realized for the necessity of three dimensional object model realization. As the result of the measurement we also receive two kinds of additional data which should be also described:

- A point cloud with a resolution from 200 up to 2 000 point per square meter. The accuracy of one point localization is about +/- 2 cm. For planar surfaces with proper structure, like roads for example the accuracy of the measurement is about +/- 0,5 cm;
- Survey photos which are a part of measured object documentation. Photos enables us to realize measurements of coordinates with an accuracy of +/- 10 cm

Registered point cloud is considered as virtual, precise model of measured object. This technique is quite often used in creation of certain products which also should be described and defined:

- Inventory measurements with special focus on the condition of road surface. There is a possibility to realize w precise models of road surfaces covering all of the scratches and damages in the structure.

- Realization of maps for the project purposes, NMT measurements, tunnel measurements, railway tracks measurements;
- Measurements of buildings across the length of the street.

Current situation is that the MLS technology is the best developer category of laser scanning in terms of proper standard creation determining way of archiving and exchanging the data gained within the usage of this system. The leaders in such works are United States of America trying to define these aspects in governmental works covering the issues of standardization NIST (National Institute of Standards and Technology), like also other research units in certain States. Throughout these units most of the works are being realized in California State where regional office for transport and logistics CALTRANS has already published across a demand to scientific institutes mentioning the need of finding a best solution for this issue.

2.3 Aerial laser scanning LIDAR

LIDAR LIght Detection And Ranging relates to the technology of XYZ coordinates survey on the surface of the ground by means of laser scanner installed on the board of flying unit. Characteristic element of LIAR technology is the fact that the measurement is realized from airplane or helicopter and the measured object is the surface of Earth or shallow water reservoirs. As the result of the survey a point cloud is considered, which is nothing else like a set of XYZ coordinates registered by laser beam on the ground. Density of point cloud varies from 1 up to 40 points/m^2.

LIDAR platform consists of certain elements:

- Flying unit. In most of the cases it is a photogrammetric airplane with set of wholes cutted in the bottom of the body where special camera is being putted, or helicopter where scanner is hanged in the bottom of body in special nest;
- Scanner working in profile setting. Profiles are being registered in combination with forward movement of airplane and gives as a result a three dimensional point cloud;
- Inertial navigation system (INS) – consisted of gyroscopes and accelerometers like also tilt meters which enables us to define movements and shakes of the airplane;
- GPS receiver working in KINEMATIC function, which supports workflow of INS system;
- Survey camera, which enables to realize photogrammetric photos. Photos are simplifying the process of point cloud orientation; and enables to generate separate product – orthophotomap;
- System of flight management;
- Data registration unit;

Characteristics of LIDAR system:

- Resolution and geometrical accuracy of point cloud – precision of survey and output resolution of point cloud depends from used system (scanner) and altitude of flight. Accuracy of single point measurement varies between 7 – 30 cm, and density from one up dozens points per square meter. Each survey task needs to be analyzed in the aspect of choice of certain parameter:
    - Type of the scanner;
    - Type of the airplane;

- Altitude of flight;
- Density and accuracy of survey (factor directly correlated with earlier mentioned elements)

Below comparison of characteristic properties of LIDAR system mounted on helicopter and airplane has been presented.

- Multiple signal echo es – specifics of registered point cloud bases on collecting few reflections of the same laser beam. Thanks to that we are able to register coordinates of the points settled above the terrain level (for example trees), like also on the ground. Analysis of signal reflection accelerates and simplify classification of the point cloud as much as separately digital terrain model DTM from digital elevation terrain model DETM. It is important to notice that LIDAR system is specified by high range of possibility of vegetation penetration and realization of ground measurement, thanks to which is irresistible surveying technique in hardly accessible places.
- Aerial images – LIDAR scanning systems are combined with midrange photogrammetric photo cameras. Images are simplifying interpretation of the point cloud, like also they enables to realize independent measurements and orthophotomap production.

Offered products:

- Digital Terrain Model (DTM) , and Digital Elevation Terrain Model DETM-models are being realized as a consequence result of point cloud classification. They are archived as a set of points with defined number of points per square meter
- Maps- LIDAR technique enables to prepare measurements with an accuracy related to the map for project purposes
- Orthophotomaps
- Vector three dimensional models

At presence the aspect of standards development related with projects using data from aerial platforms is still not solved. Some references to standards like ISO 19139 (ISO, 2005) or ISO 19115 (ISO, 2003) appears, but there are documents not covering directly about data from LIDAR system measurement. It is important to notice the fact that specially this type of scanning should be in the field of interest because of customers who are ordering products realized in this way. Because they are representing territorial offices, administration representatives, governmental subsidiaries for whom aspect of unification, and standardization is the key to proper existence. And without well working interoperability of harmonized data there is no chance for that.

To summarize TLS, ALS and MLS characteristic mentioned above it is important to focus on the aspect of metadata which should cover issues related not only to registration of information by means of laser scanning but also elements related to documentary products realized while their post processing. Authors of the publication focus mainly on systematization of data capture process, however in relation to such problems like building architectural inventorization there is a need of implementing clearly and precisely determining standards covering aspects of products properties. As an example we can put orthophotomaps, 2D and 3D visualizations, elevation views, sets of sections or any map documentations. Authors suggests that further deep analysis of these elements is necessary,

and should enable us to correct a quality of offered solutions as much as to simplify access to them like also implementing proper systematization in accordance to demand putted in front of products, their collection, categorization and usage for further purposes and pos processing. This topic is so broad that is was only possible to indicate it, but its full analysis need, puts us in front of the next research which should be done.

3. SUGGESTED IDEA FOR UNIVERSAL CREATION OF STANDARD FOR LASER SCANNING TECHNOLOGY

The authors of the publication in previous works mentioned in the introduction have created a standard data matrix, basing directly on the information gained within the usage of terrestrial laser scanner, and directed for the field cooperating with architectural and building inventory documentation creation. What is more in analysis provided in this particular publication they want to come back to it by showing its potential collocation with mentioned standardization of metadata.
The standardization matrix is presented on Fig. 1, it is called a product class matrix, and defines in simple and precise way a division which enables us to characterize and determine properties of each product being a result of terrestrial laser scanning technology usage.

- D stands for geometrical precision category, beginning with general measurement (D1) and ending on precise measurement covering all of the accuracy criteria (D5);
- S stands for category of semantic description startin with general definition (S1) and ending on precise spatial database (S5);
- Q stands for product class in the meaning of certain object characterization elements amount.

	D1	**D2**	**D3**	**D4**	**D5**
S1	**Q1**			**Q14**	
S2		**Q2**			
S3			**Q3**		
S4				**Q4**	
S5		**Q52**			**Q5**

Fig.1 Product class matrix

The authors suggests that a possibility of systematization in accordance to description, geometrical and as a result out of this two quality value could become an unappreciate until know, help in lining up all of the realized works in terms of preparation of universal standard for end product. In unchangeable way it can be used as a formula for documentations which are the result of post processing the data from terrestrial, mobile and

aerial laser scanning, because following the simple rule it covers with its conceptual design all of the same variants and generalization parameters. Products (as shown on Pic. 2, and Pic.3), as the results of realized measurements and effect of their post processing, can become a universal definition, which would be so important for proper interoperability of all of the part elements on the way to fulfillment of the INSPIRE Directive demands. It will enable us to prepare a homogeneous standard for the documentations basing on the usage of laser scanning as a method for spatial data acquisition and will become a unappreciated until now base with simple access and clear structure, which could be easily described by metadata defined in this particular way (Pic. 4).

Fig. 2 Examples of realized works and end products according to the matrix of product quality , from the left: Q4, Q4, Q2 (source Scan3D Polska http://www.scan3d.com)

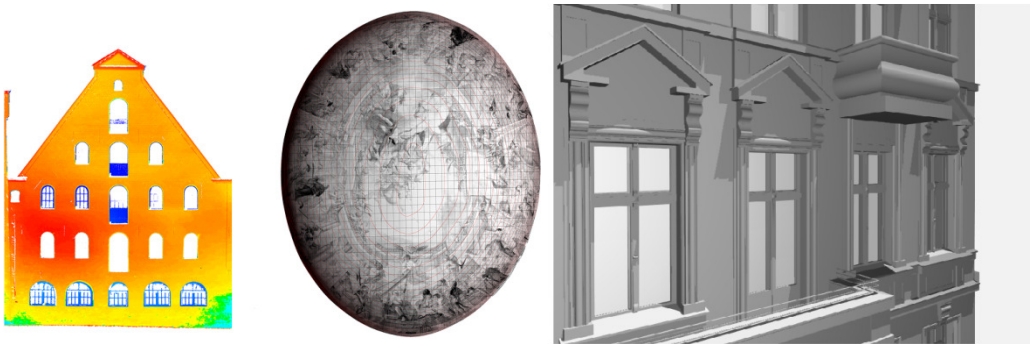

Fig. 3 Quality of realized works according to the matrix of class of the product, from the left: Q3, Q3, Q3 (source Scan3D Polska http://www.scan3d.com)

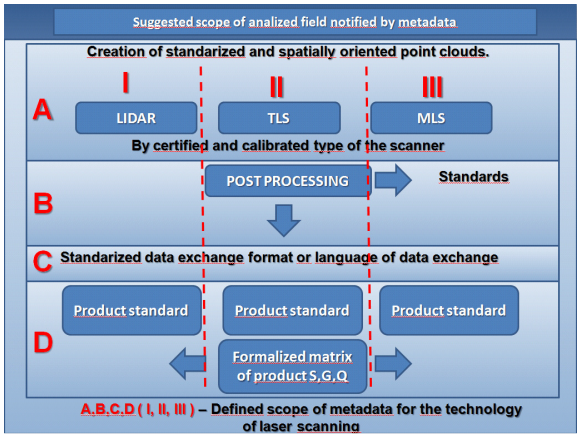

Fig. 4 Metadata matrix for the technology of laser scanning

4. AN ATTEMPT OF METADATA FOR LASER SCANNING TECHNOLOGY

In Poland as a basis for determining components of metadata set is considered document „Commision regulation (WE) NR 1205/2008 from 3 Dec 2008 r. in the field of realization of directive 2007/2/WE of European Parliament and Board in the area of metadata" (Regulation KE, 2008). Metadata elements covered in regulation treats about:

1. Identification of the set, series of sets or service,
2. Classification of spatial data and spatial data services,
3. Key Word (if metadata describe a service),
4. Geographical postioning,
5. Time relation,
6. Quality and importance of spatial data,
7. accuracy (with realization rules),
8. demands according to access and usage,
9. organization responsible for creation of the collection,
10. metadata about metadata.

It is, as it looks, basic, obligatory set of metadata. Suggestion of the authors leads to extension of this scope with key parameters covering laser scanning. Exceed means that the collections of metadata would contain all of the metadata elements mentioned above and the ones covered by laser scanning for the sets gained by the usage of laser scanning technology.

In normative ISO 19115 covering metadata (ISO, 2003) such possibility is predicted (fig. 5).Therefore the model of

exceeded metadata information from the normative 19115 would look like on fig.5

The author's suggestion covers concretion of the extension leading to laser scanning. Ideal scheme of metadata extension is presented in Fig.6. Where class MD_LaserScanning (Fig. 2) being a part of extended information represented on model by class MD_MetadataExtendedInformation would be partly described by class MD_ExtendedElementInformation.

On Fig.7 a precise conceptual model of metadata for technology of laser scanning has been presented. Still in many aspects this is not considered as a sufficient schematic model. Some notifications of attributes types haven't been defined like for ex ample: PP_Type, because current situation puts us face to face with many standardization decisions like for instance question which procedures in post processing and their descriptions should be considered as standard. The same situation occurs while calibrating a laser. There is lack of standards for such calibration realization, so it is very hard to speak about concrete scheme shape from calibration. There is also a need to determine ways of orienting the laser beam (for example adjustment to existing surveying net) – as much as précising proper accuracy. Therefore on Fig.7 this aspect was only suggested by the type of the name GM_Orientation. The GM prefix should point out that this type will contain geometrical elements. There is a need to determine acceptable accuracies, resolutions and so on, for point clouds and for end products. In other words, to fulfill the matrix of class product with proper information.

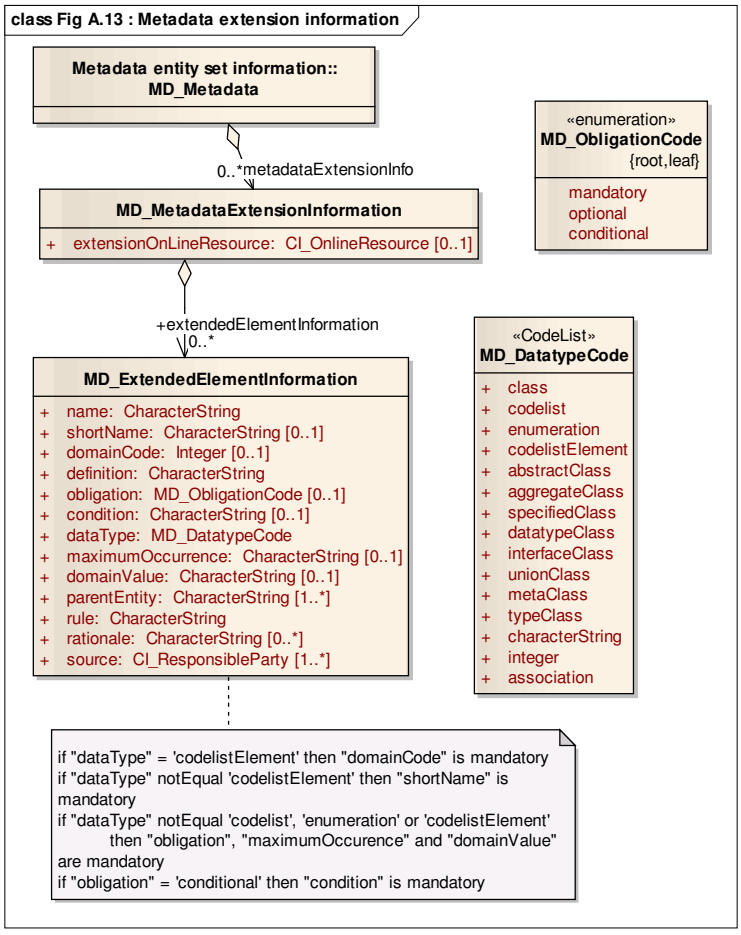

Fig. 5 The model of exceeded metadata information from the normative 19115

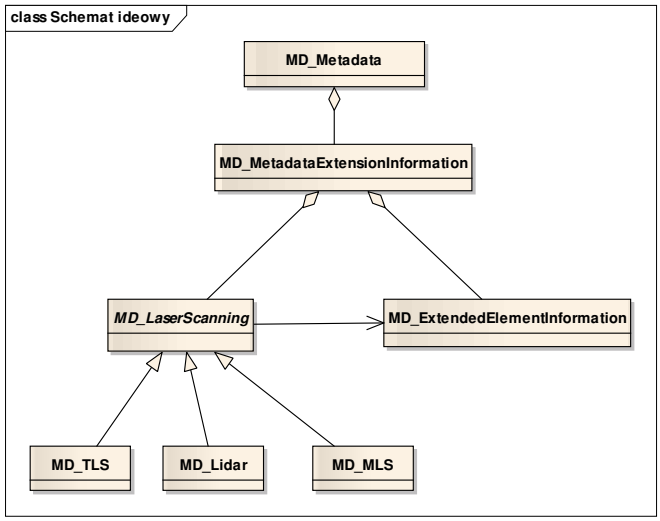

Fig. 6 Ideal scheme of metadata collection extension

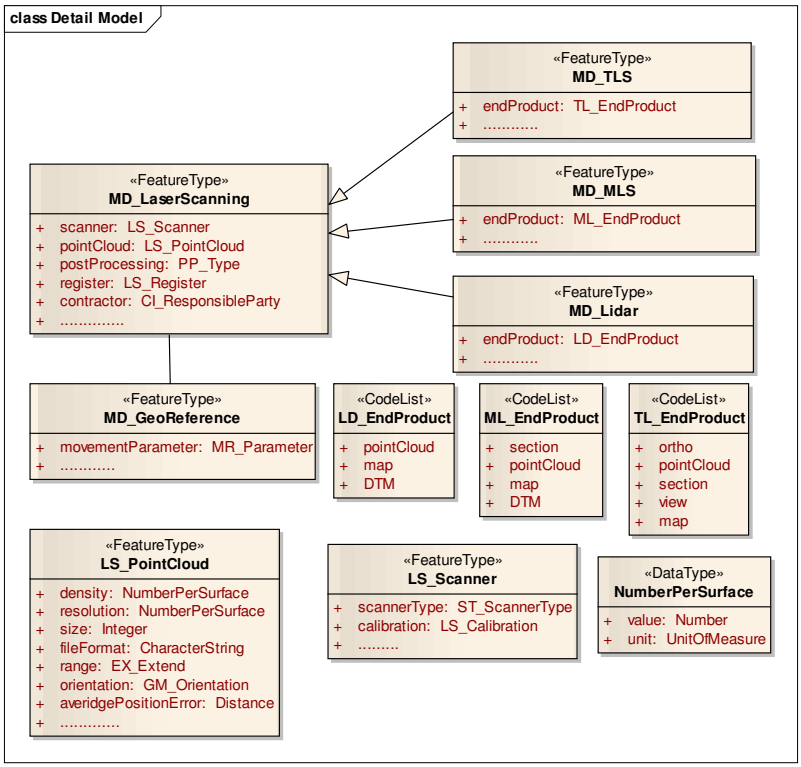

Fig. 7 Suggestion for the meta data model for laser scanning, unit in NumberPerSurface class is N/m^2.

According to previous suggestion of metadata division into metadata for collections,data and technology class MD_LaserScanning and LS_Scanner belong to metadata describing technology, LS_PointCloud describes data and in the same time also the collection, because the point cloud is going to be archived in the form of a set. Classes MD_TLS, MD_MLS and MD_Lidar also describes data (here in the form of end products, which are going to be the data for different further works) and in the same time the sets of these data.

5. CONCLUSION

Concluding aspects mentioned in this publication authors want to emphasize the need for metadata creation for laser scanning technology. The best justification can be brought by the citation from Professor Elżbieta Bielecka publication, where we can find that the main barrier for complete usage of accessible data is the fact of time consumption and relatively high cost of looking for the existing spatial data as much as checking, if they can be used in certain application. To eliminate such problems spatial data sets like also services should be described in the form of metadata. The role of metadata is simplifying the process of defining the scope of information being offered by geoinformatic sets like also determining possibilities of finding them and valuating in the aspect of individual needs of the users.
One of the goals of this publication is, despite creating the suggestion for metadata, a attempt to interest all of the people coping with this topic in initiating further works in this field, works which should be ended by standards for laser scanning aspect like LIDAR, TLS or MMT preparation.
Because it is known that in the aspect of metadata at presence there are serious projects being realized, also by Open Archives Institute, and written in Protocol for Metadata Harvesting, it is important that in the final determination of the metadata shape suggested for laser scanning technology they will be also considered and treated very serious.
Solution suggested by the authors enabling continuation of further works above the aspects of standardized documents realized with a basis of data and products delivered by laser scanning seems to fully justify the sense and rationality of such ideas implementation. The only way is to systemize in this way all of registered information like also to harmonize them which can assure us simplicity and usefulness of such archived collections usage and full interoperational status for the needs of different economic sectors and industrial branches of particular country. However it looks that they require the implementation to realized works some of the representatives from the other European countries focused around thematic of normative standardization development.
Leaving the problem without any re action will assure further development of mentioned field but in distracted form without any coordination or supervision.

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