Storage and analysis of city models, and relationship to BIM (4hp)

Study period: 25-28 March + 1 day in May/June 2019

Aim: Learn about international and Swedish standards for city models, mainly CityGML, as well as raster-based high resolution digital surface models (DSM). Obtain basic understanding and practical experience of analyses based on city models as well as environmental modelling exploiting urban GIS-based raster models. Understand the relationship between city models and BIM-data. Understand the role of city models (and partly BIM-data) in the built environment process.

Target group: PhD students, Professionals

Prerequisites: Theoretical knowledge and practical experience in either GIS or BIM.

Location: The course will be given in Lund

Examiner and contact: Lars Harrie. LU, lars.harrie@nateko.lu.se

Teachers: Martin Hooper, Sweco
Fredrik Lindberg, GU
Perola Olsson, LU
Lars Harrie, LU
Guest teacher from a company, likely ESRI-Sweden

Language: The course will be provided in English if required.

Examination: Short written text and presentation of a project work. The theme of the project work will be set individually based on PhD-topic or working environment.

Application: Mail to Lars Harrie (lars.harrie@nateko.lu.se) at latest 22 February.

Maximum number of participants: 20

Cost: The course is free. This course is a part of a course package financed by Smart Built Environment.

Preliminary detailed schedule

Day 1: 25 March

13.00-14.00 Introduction to city models – current status and applications (LH)

14.15 – 15.00 Standardisation of city models (CityGML and Swedish standards) (LH)

15.00-17.00 City model - Practical exercise (TBD)

Day 2: 26 March

9.15-10.00 Introduction to raster data and grid based environmental modelling (FL)

10.15 – 12.00 Practical exercise - Production of raster DSMs (Vector and LiDAR data based) (FL)

12-13 Lunch

13.15-14.00 00 Practical exercise - Production of raster DSMs (Vector and LiDAR data based) cont.

14.15-17.00 Practical exercise - Raster based environmental modelling in urban areas (FL)

Day 3: 27 March

8.00-10.00 Theory/practice Raster (FL)

10.15-11.00 Introduction to BIM (MH)

11.15-12.00 Standardisation of BIM (IFC) (MH)

12-13 Lunch

13.15-14.00 BIM, xxx (MH)

14.00-17.00 BIM exercise (MH)

Day 4: 28 March

8.00-10.00 BIM exercise (MH)

10.15 – 11.00 CityModels and BIM in the Swedish built environment process. (LH)

11.15-12.00 CityModels and BIM in the building permit process. (PO)

12-13 Lunch

13.15-17.00 Practical exercise + individual discussion about project topic (PO, LH, et al)

Day 5: To be decided: Seminar – project reporting

Course literature (preliminary)

Andrée M., Larsson K., Nordqvist Darell F., Malm L., Tullberg O., Wallberg A., Norrsell J., Paasch J., Seipel S. and Paulsson J., 2017. BIM som informationsstöd för 3D fastighetsbildning. *Project report in Smart Built Environment project "Smart Planering för Byggande".*

Arroyo Ohori K., Biljecki F., Diakité A., Krijnen T.F., Ledoux H., and Stoter, J., 2017. Towards an integration of GIS and BIM data: What are the geometric and topological issues? *ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, Vol. IV-4W5, pp. 1-8

Biljecki F., Stoter J., Ledoux H., Zlatanova S., Çöltekin, 2015. A. Applications of 3D City Models: State of the Art Review. *ISPRS International Journal of Geo-Information*. 4(4):2842-2889.

Biljecki F., Heuvelink G. B.M., Ledoux H. and Stoter J., 2018. The effect of acquisition error and level of detail on the accuracy of spatial analyses, Cartography and Geographic Information Science, 45:2, 156-176.

Donkers S., Ledoux H., Zhao J. and Stoter J., 2016. Automatic conversion of IFC datasets to geometrically and semanticaly correct CityGML LOD3 buildings. *Transactions in GIS*, 2016, 20(4): 547–569.

El-Mekawy M., Östman, A., and Hijazi I., 2012. I. A Unified Building Model for 3D Urban GIS. *ISPRS Int. J. Geo-Inf.*, 1:120–145.

Ellul C., J. Stoter, L. Harrie, M. Shariat, A. Behan, M. Pla, 2018. Investigating the state of play of GeoBIM across Europe. *Proceedings of 3D GeoInfo*, Delft 1-2 October.

Eriksson, H., L. Harrie and J. M. Paasch, 2018. What is the need for building parts? - A comparison of CityGML, INSPIRE Building and a Swedish building standard. *Proceedings of 3D GeoInfo*, Delft 1-2 October.

Gröger G., Kolbe T.H., Nagel C. and Häfele K.-H. (eds.), 2012. OGC City Geography Markup Language (CityGML) Encoding Standard, Version 2.0, OGC Doc No. 12-019, Open Geospatial Consortium.

Gröger G., and Plümer L., 2012. CityGML – interoperable semantic 3D city models. ISPRS J. Photogramm. Rem. Sens. 71:12–33.

Lindberg F, Grimmond, C.S.B., Gabey, A., Huang, B., Kent, C.W., Sun, T., Theeuwes, N., Järvi, L., Ward, H., Capel-Timms, I., Chang, Y.Y., Jonsson, P., Krave, N., Liu, D., Meyer, D., Olofson, F., Tan, J.G., Wästberg, D., Xue, L., Zhang, Z. (2018) Urban Multi-scale Environmental Predictor (UMEP): An integrated tool for city-based climate services. Environmental Modelling and Software. 99, 70-87.

Lindberg, F., Jonsson, P. & Honjo, T. and Wästberg, D. (2015) Solar energy on building envelopes - 3D modelling in a 2D environment. Solar Energy. 115 (2015) 369–378

Lindberg, F. and Grimmond, C. (2011) Nature of vegetation and building morphology characteristics across a city: Influence on shadow patterns and mean radiant temperatures in London. Urban Ecosystems 14:4, 617-634.

Lindberg, F. (2005) Towards the use of local governmental 3-d data within urban climatology studies. Mapping and Image Science 2, 4-9.

Liu X., Wang X.Y., Wright, G., Cheng, J.C.P., Li, X., Liu, and R., 2017. A State-of-the-Art Review on the Integration of Building Information Modeling (BIM) and Geographic Information System (GIS). *International Journal of Geo-Information*, 6:53.

OGC, 2012. OGC City Geography Markup Language (CityGML) Encoding Standard 2.0.0, Technical Report.

Olsson, P.-O. Conversion of an IFC-model to a lod2-3 3D-GIS building model. In Proceedings of the AGILE Conference, Lund, Sweden, 12–15 June 2018.

Olsson P.-O., Axelsson J., Hooper M., Harrie L., 2018. Automation of Building Permission by Integration of BIM and Geospatial Data. *ISPRS Int. J. Geo-Inf.* Vol. *7*, pp. 307-328. doi: 10.3390/ijgi7080307. Available at: https://doi.org/10.3390/ijgi7080307

SS-EN ISO 16739:2016 Industry Foundation Classes (IFC) för datautbyte i byggande och förvaltning.

Svensk geoprocess, 2018. Geodataspecifikation, Byggnad, version 3.0, 2018-01-15.

Tarandi V., 2015. A BIM collaboration lab for improved through life support. *Procedia Economics and Finance*, 21, pp. 383 – 390.