Required Components for Landscape Information Modelling (LIM): A Literature Review

Veronika ZAHRAĐKOVÁ¹ and Henri ACHTEN²
¹Fa CVUT, Prague/Czech Republic · zahradkova.veronika@email.cz
²Fa CVUT, Prague/Czech Republic

Extended Abstract

In this paper we report on a PhD project, in which an extension of the concept of “Building Information Modelling” (BIM) was discussed, aimed at the landscape design community. The potential benefits of BIM in the field of architecture have been reported many times. As a technology, various instances of BIM can be found throughout many applications in the Building & Construction Industry; however in our research, we did not find any similar application of the BIM principle for landscape design.

1 Literature Survey

This paper is not the first to perceive benefits in the application of BIM for landscape design. In 1989, DANAHY and WRIGHT proposed a research agenda for integrated CAD & GIS. Through an international effort, the groundbreaking application “Polytrim” was developed in the early 1990’s (DANAHY & HOINKERS 1995). Most proposals extended upon GIS as a database structure to provide an exchangeable format (for example, HOMMA et al. 1999). For landscape and urban design, analysis over a given time is an important feature. Simulation and assessment of changing conditions are required in order to obtain a complete understanding of a region (CANEPARO et al. 2005). Simulation techniques can also be used to obtain feasible proposals for landscape design (SLAGER et al. 2008).

The integration of knowledge and skills from both architecture and landscape design is rare. FRICKER et al. (2013) demonstrate a series of mixed techniques from architecture for landscape architects. GÓMEZ et al. (2013) propose an integration of BIM and GIS for a Campus Landscape Information Model. An interesting publication by CHEN and YUAN (2014) introduces Excel to the BIM process as a universal information storage technology; to aid intelligent data analysis and visualisations.

The BIM Academy (Northumbria University) teaches Landscape Architects how to work with BIM tools; however upon approaching them for comment, it was stated that in BIM Academy is no research and publication on this topic to date. The very fact landscape consultants are all thinking about implementing BIM now and want to push forward on this will encourage the developers to invest in providing these necessary tools. (Justine Gray, Senior Project Manager, BIM Academy)

Landscape architects are currently using BIM tools for their various designs, but this software is not 100% compatible with all landscape tasks; available software is modified to enable users to ‘make do’ and progress with their designs (AHMAD and ALIYU 2012).
Another element focused on within the survey was the BIM components themselves. In the writers’ opinion, the most important elements are the plants; their growth, fenology and interaction with the surrounding conditions, and with other plants. Some species are susceptible to a wide range of ecological factors; others are naturally scarce because their ecological amplitude is narrow (ÚRADNÍČEK 2010). There are several publications discussing dendrometry of original species for central Europe (HALAJ 1979, ŠMELKO 2003).

2 Questions

2.1 What Information Should LIM Contain?

Input data taken from GIS databases include the climatic, hydrological and pedological conditions of the site. Topographical data may be taken from GIS as well, but for smaller scales the accurate geodetical measurement would be preferable. Another important input is the state of existing vegetation. This should be also taken directly, by dendrological survey (if possible, 3D scanning) on site.

Further data is added throughout the design process, including the vegetation, solid surfaces, furnishing, water elements, earthwork et cetera. These objects will typically be taken from a library, or created in the model as unique objects.

Analyses, visualisations and schedules can then all be exported from the LIM as deliverables.

2.2 How Could Landscape Architects Use LIM?

Landscape architects could create designs based on the accessible data stored within the model, which can help in decision making and aid the demonstration of their design to other parties involved in the project. There might be several phases to the design:-

1. Concept / preliminary design: In this phase, the architect works with space. Terrain and proportions should be solved in that phase.

2. Study: In the second phase, the vegetation should be planned. The architect should choose the type of plants, taking into account the seasonal aspect, and aging which would affect the impression of the space according to the timeline.

3. Detailed documentation: In the final phase of design, the architect should specify precisely the types of plants, paving, furnishings and other accessories. Accurate schedules of elements, quantities of plants, seeds, volume of earthwork et cetera, would all be completed automatically.

The landscape information modelling process allows knowledge capture and representation which is currently not available. Similarly as in architectural and urban design, in landscape design multiple parties are involved (landscape designers, municipality, urban planners, et cetera). Reliable exchange of information during the design, realisation, and management phases will increase efficiencies, reduce errors, and reduce the risk of (costly) corrections.
3 Conclusion and Outlook

Should an information model for landscape become available, it would allow for easier integration between landscape, urban and architectural design, through the exchange of information models. This is important to note, because landscape design is naturally immersed in urban structures; parks, green areas, public spaces, and the immediate surroundings of buildings are often the subject of landscape design. Therefore a more fluent link via a Landscape Information Model between architecture, urban design, and landscape design would be very beneficial. Moving forward, the next stage is to create an app for integration within existing BIM software and to test it via case studies, in order to prove feasibility, and to evaluate the popularity of a dedicated landscape information modelling tool.

4 Introduction to Poster Presentation: What Information Should LIM Contain?

In the writers’ opinion, there are three major benefits to be gained in applying BIM principles to landscape design:

- The provision of an information model for the domain of landscape design.
- An information model which supports multiple participants in the design process.
- Integration of landscape design with urban and building designs.

Based on the literature review, and on the development of ideas within the research project, it is proposed that the information model should contain the aspects shown in fig 1 below:

Fig. 1: LIM model diagram

Input data taken from GIS databases include the climatic, hydrological and pedological conditions of the site. Topographical data may be taken from GIS as well, but for smaller
scales the accurate geodetical measurement would be preferable. Another important input is the state of existing vegetation. This should be also taken directly, by dendrological survey (if possible, 3D scanning) on site.

Further data is added throughout the design process, including the vegetation (Fig. 2), solid surfaces, furnishing, water elements, earthwork et cetera. These objects will typically be taken from a library, or created in the model as unique objects.

Analyses, visualisations and schedules can then all be exported from the LIM as deliverables.

**Fig. 2:** Plants as components for LIM model

**Conclusion and Outlook**

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