Using 3D GIS to Sustain our Campuses

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Buildings account for nine percent of US gross domestic product and almost half the country’s greenhouse gas emissions and energy use. The impact of development over the last few decades is clear. With tools to forecast the impacts, the market and consumers would have been better informed regarding more sustainable alternatives.

The buildings industry is still biased toward a paper-driven model, or one with unstructured digital data having no real connection or spatial context to the world at large. One impact is the persistence of erroneous building data within authoritative systems for educational institutions and associated campuses. Another is the difficulty accessing and integrating it across multiple systems. This certainly is not helpful when efficient and instant access to accurate building information is required (National Institute of Science and Technology (NIST), 2004, pp. 3-1–3-6). Our campuses and the buildings within them are inherently 3D, so the foundation for smarter buildings and campuses will not be based on paper, unstructured 2D systems, or even highly structured 3D technologies that are difficult to integrate with other systems. To understand and resolve the challenges facing those managing, working and living within campuses, systems providing greater context for individual building objects are critical.

Geographic Information Systems (GIS) is emerging in a new role within the industry for better communication, analysis, and interoperability. By restructuring Computer Aided Design (CAD) and Building Information Model (BIM) technology to take advantage of the inherent spatial relationships in a GIS, building information (BI) can be aggregated at all scales and integrated with other management systems throughout the building lifecycle. GIS can be exploited to provide key information for decision makers, so they can answer questions regarding the best manner to develop and manage campuses. It enables improvement of the urban form by providing the awareness needed to expose hidden patterns affecting performance, allowing those deficiencies to be corrected; thereby, ensuring its future viability. For example, using 2D, procedural, and Building Information Model (BIM) derived data to conduct urban growth modeling, zoning change visualization, and view quality/impact assessment. Forecasting the future is a fuzzy science, but one clear step we can take to reverse old and unfavorable trends is to realize that GIS can and should play a key role in managing and sustaining campuses.

GIS technology can be exploited to provide key facility information for decision makers when they need it. In this context it is used to answer questions regarding the best manner to develop and manage campuses. This ability is largely a result of the relational database technology underlying it, as well as the capacity for GIS to identify spatially related objects. Spatial relationships allow GIS to merge different worlds of knowledge—it is significant and powerful
because it unearths and exposes related patterns that would otherwise go undiscovered. It is a powerful system and enabling technology for shaping and managing campuses—one that:

- Provides a common and coordinated view, thereby increasing collaboration and understanding, while reducing risk and its associated costs.
- Enables visualization, analysis and comparison of possible alternatives to optimize performance, providing the analytical tools necessary for determining which strategy is the best short and long term solution.
- Can provide the support the building industry requires to realize more sustainable development practices and patterns.

The buildings industry is no doubt integral to the U.S. economy, having accounted for nearly nine percent of all US gross domestic product (GDP) during since 1980 (Pacific Northwest National Laboratory, 2010, 1.3.1, 1.3.2). It’s also an industry where the output (buildings) accounts for almost half the country’s greenhouse gas emissions and energy use (National Research Council (NRC), 2011, pp. S-2). With the benefit of hindsight these trends and the cumulative net impact of previous individual actions become clear. Had there been tools available to forecast the short- and long-term impacts of proposed development, the market, and consumers, would have been better informed regarding more sustainable alternatives. In this manner, it would have been possible for developers and architects to configure more efficient layouts to achieve the same net square feet (NSF) as other alternatives with more gross square feet (GSF) for the purpose of increasing profitability for developers and reducing energy costs for consumers.

It is clear today that enabling technology, such as GIS, provides industry managers and executives the tools required to be better stewards of the built environment. The common and coordinated awareness that GIS delivers provides a better understanding of the present. Shared awareness enables stakeholders to visualize and analyze data regarding the built environment, and its links to the world at large. This enables better collaboration among stakeholder disciplines; thereby, reducing the unknowns, leading to lower project contingencies, risk and cost.

By spatially organizing and linking the standards, policies and values that guide the development and ultimate form of the built environment to the analysis required to achieve shared awareness, GIS helps industry stakeholders to better understand the future. In this way, GIS provides stakeholders the predictive capability needed to manage and actualize performance of campuses. This ability allows decision makers to visualize performance and virtualize scenarios to improve the campuses they manage, thus ensuring its future viability. For example, it allows facility managers to abandon run-to-failure maintenance strategies, and instead adopt strategies for preventative and reliability centered maintenance, which can dramatically lengthen facility service lives, as well as reduce operating costs.

In conclusion, the past generation of ineffective communications and data interoperability has been a big resource drain for building owners and managers, as well as for the campuses where these buildings are located. Enabling smarter buildings and campuses requires us to correct these deficiencies. Forecasting the future is generally a fuzzy science, but one clear step
to reverse old and unfavorable trends is to realize that a more practical CAD and BIM technology, one with better GIS interoperability, can and should play a key role in managing and sustaining the built environment and the world.

As shown in the figures below, a GIS-based system for managing campus facilities can provide facility and real property stakeholders at a campus the awareness required to manage it, as well as the technology, tools and processes required to actualize its potential for optimal performance. GIS for the facilities and real property is powered by a Facilities Information Model (FIM), which serves as the primary data source for all managed facilities, throughout the entire Facility Management (FM) lifecycle. Information contained in the FIM can be visualized in geographic space via the GIS, thereby providing users of the system a common and coordinated view of the built environment. By further linking the FIM to authoritative data sources, stakeholder workflows, needed reports, and relevant standards, GIS provides industry stakeholders a predictive capability essential for understanding the future, as well as for optimizing it.
Works Cited