



Consulting Engineers of Alberta

Building Information Modeling (BIM) Position Paper

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1.0 Terms of Reference

BIM is being used more extensively in all areas of the Architecture, Engineering, Construction, Owner, and Operator (AECOO) community. It is the goal of this paper to consider the engagement of CEA member firms in the application and development of BIM practices, to note aspects of BIM adoption that are of consequence to CEA member firms, and concisely represent the CEA's current position on the use of BIM for the benefit of membership, partners, and client groups.

The CEA recognizes the complexity of using BIM in today's risk averse industry and would like to offer suggestions on how we might view the use of BIM in the current marketplace while offering a starting point for further discussion.

2.0 What Is BIM?

Building Information Modeling (BIM) is:

“the creation and use of coordinated, internally consistent, computable information about a project in design and construction”

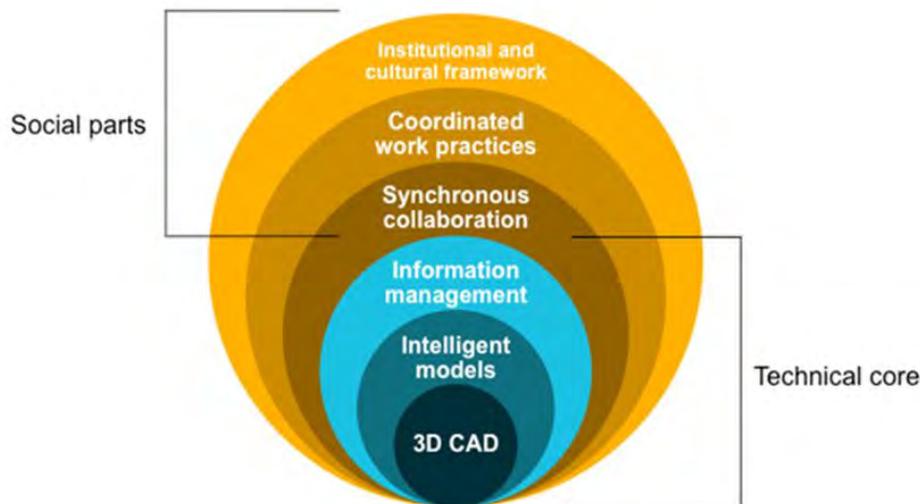
– AEC (CAN) BIM Protocol Version 1.0, released by the Canada BIM Council (CanBIM) in October 2012.

or it can be called:

“a digital representation of physical and functional characteristics of a facility. A building information model is a shared knowledge resource for information about a facility forming a reliable basis for decisions during it's life-cycle; defined as existing from earliest conception to demolition.”

–The National Building Information Model Standard Project Committee, BuildingSMART International

BIM is not a piece of software, but rather a wide ranging information management philosophy and business process.



BIM viewed as a sociotechnical system with a technological base and layers of social components

Image From:
Mondrup, T. F., Karlshøj, J., & Vestergaard, F. (2012). Communicate and collaborate by using building information modeling. Paper presented at CIB W078 2012 Conference, Beirut, Lebanon.

3.0 Project Types Appropriate for BIM

BIM is not limited to vertical infrastructure (i.e. Buildings), but rather, can be employed for any type of construction project. This includes civil infrastructure, transportation, bridges, water/wastewater, utilities, hydro and many more.

4.0 Reasons For Adopting BIM Within The AECOO Community

Some of the ways in which members of the CEA, and the clients that they serve, may gain value from BIM are as follows:

- Providing a platform for multi-party collaboration and clash detection prior to construction,
- Providing robust pre-construction visualization to improve client experience.
- Facilitating expanded or value added service offerings,
- Performing predictive performance analyses on a digital prototype of a facility,
- Bypassing traditional forms of documentation or producing them more efficiently,
- Improving efficiency of effort and information exchange, and,
- Making digital information available beyond construction for use in lifecycle management and operations.

5.0 How Are BIM Tools And Approaches Applied?

BIM adoption differs from previous transitions between hand drafting and Computer Aided Drafting (CAD). Full BIM implementation will require extensive changes to previously established workflows and requires completely revised approaches to the delivery of a project. BIM is an industry changer, whereas CAD was simply a drawing method changer. The transition becomes more disruptive to the status quo, as firms and project teams strive for more integrated levels of BIM. This is illustrated well by the 'Roadmap to Lifecycle BIM in the Canadian AECOO Community'¹, published by BuildingSmart Canada. Participants must approach projects with the full awareness of this and choose the level of BIM that suits their capability and project goals.

A successful BIM project is executed through:

- The presence of contractual arrangements that facilitate collaborative BIM workflows (refer to the '[Contract Language Documents Package](#)' by IBC/bSC²),
- The implementation of a comprehensive BIM Project Execution Plan (PxP); (refer to the [BIM PXP Toolkit](#) published by IBC/bSC),
- Adherence to clearly defined BIM Levels of Development and the PxP; (refer to [The American Institute of Architects](#)³ & [BIMForum](#)⁴)
- The execution of enhanced collaboration between all parties.

¹ <https://www.buildingsmartcanada.ca/roadmap-to-lifecycle-bim/>

² <https://www.ibc-bim.ca/documents/>

³ <http://www.aia.org>

⁴ <https://bimforum.org/>

6.0 What Do Consulting Engineers Contribute to BIMs?

Consulting Engineers bring specialized subject matter expertise and professional accountability to the information they provide to a Building Information Model. The design knowledge, expertise, and experience of a consulting engineer is used to identify the problems, define coordinated design parameters, and formulate applicable solutions to ensure that the end goal is attained.

7.0 How Does the Use of BIM Affect the Project Scope of Services (Effort And Fees) For Consulting Engineers?

BIM workflows and processes allow finer levels of interdisciplinary design and pre-construction coordination to be achieved but often at the expenditure of additional effort and resources relative to traditional methods where the development of some details are passed to the constructors.

Highly collaborative design processes can often incur a higher degree of rework as design solutions are arrived at through numerous multi-disciplinary iterations. These can be minimized somewhat with very careful planning, but not likely eliminated.

If projects include upgrades to existing facilities, the creation of an information model to represent that existing state can incur significant effort relative to the development of traditional pre-design, as-built, drawings. However, without an accurate representation of existing conditions, all subsequent BIM data will carry inherent and perhaps unforeseen errors. Techniques like 3-D scanning are vital for incorporating existing conditions into a BIM efficiently and accurately.

The scope of services required are directly related to the Level of Development (LOD) that must be achieved by contributors to the BIM. Similarly, the fact that BIM can facilitate deeper design analysis or pre-construction studies does not mean that they come without effort on the part of the consulting engineer. As such, the scope must be defined clearly prior to the development of the consultant contract, and revisited as necessary, so that the necessary effort can be reflected in the agreed upon fee and compensation structures.

As has been noted, the use of BIM can offer significant value to CEA member firms and their clients. This value is often achieved through an associated degree of effort on the part of consulting professionals and therefore appropriate fees must be negotiated to correspond to the defined scope. It is recommended that fees be negotiated to match BIM scope, as such, CEA members are encouraged to refer to [CEA published scope and fee guidelines](#)⁵.

8.0 Impacts of BIM On Contracts For Consulting Engineers

The type of contractual arrangement used for a project is possibly the single greatest factor in deciding the value that can be gained from BIM workflows. Contract structures that best encourage collaboration and mutual benefit, such as IPD or multi-party agreements, will earn the most net value from BIM approaches. Contractual structures that segregate parties to the contract are likely to obtain fewer benefits from what BIM has to offer and may slow the uptake of BIM techniques.

⁵ <http://www.cea.ca/committees/buildings-committee>

Regardless of the contract type, CEA members must take care during the negotiation of contracts with their clients and sub-consultants to ensure that the scope is clear with respect to BIM, including the project execution plan, levels of development, agreed upon uses of model elements, BIM management and so on. Readers are encouraged to refer to the '[Contract Language Documents Package](#)'⁶ and the '[BIM PXP Toolkit Package](#)', published by the Institute for BIM in Canada (IBC), which can act as useful guides and appendices to typical industry contract forms. They are further encouraged to gather input from their insurers; many have published bulletins or white papers on the topic.



9.0 How Does the Rise of BIM Project Methodologies Affect the Shape And Management Of Consulting Engineering Firms?

The arrival of the digital age within facility design, construction, and management will be disruptive, transformative, and inevitable. As our industry transitions deeper into BIM, Consulting Engineering firms will transform their services, relationships, staffing, and delivery processes to be more collaborative and information based. They will continue to be subject matter experts, but will apply that specialized knowledge earlier and more often throughout a project and to a finer level of precision and integration. It affects our training requirements, the staff we must hire, and our IT needs.

10.0 The CEA Position

Building Information Modeling is a wide ranging information management philosophy that offers many opportunities to CEA member firms, their business partners, and their clients. The application of BIM workflows within the AECOO community requires a transformation of practices within consulting engineering firms and a transformation of relationships with clients and partners. Successful integration of BIM within a consulting engineering firm, and within the community at large, requires clear, proactive, planning, and communication between all levels.

⁶ <https://www.ibc-bim.ca/documents/>