

CI500005

# Demystifying technology and standards selection for infrastructure projects

Marek Suchocki  
Autodesk Ltd.

## Learning Objectives

- recognize differences between BIM deliverables, information standards, asset data obligations and open BIM
- implement a planning approach to adopt the right tools and processes for a given project
- understand how a platform approach can offer long term flexibility for changing demands
- challenge poorly crafted contractual requirements and offer recommendations on remedies

## Description

Infrastructure projects are increasingly adopting BIM in design and construction delivery, frequently driven by owner demand. Contracts are specifying BIM deliverables, adoption of standards and asset data obligations that can be daunting for inexperienced as well as more capable suppliers. This class will review example BIM obligations in infrastructure contracts to understand what is being asked, its complexity, its suitability and appropriateness, in order to consider ways of meeting the requirements. A range of strategies to deliver requirements will be discussed that will include BIM tool selection, interoperability considerations, information standards such as ISO 19650, open BIM usage and techniques for meeting data handover obligations. The value of adopting a platform approach will also be explored where organizations can leverage consistent technologies and processes between projects whilst offering flexibility to meet varying requirements and participant capability.

## Speaker

Marek is a Global Business Development in Autodesk focused on the infrastructure sector and the development of industry standards for BIM and data exchange. He holds a degree in Civil Engineering, is a Chartered Engineer, Chartered IT Professional, a Fellow of the British Computer Society and the Institution of Civil Engineers and a Member of the Chartered Institution of Civil Engineering Surveyors (CICES). He is a member of the British Standards B555 committee that prepared the UK Level 2 and subsequently ISO 19650 series of BIM Standards, is a British Standards nominated subject matter expert to CEN (European Standards Committee) for Common Data Environments (CDE) and BIM for Infrastructure, sits on the CICES Geospatial Practices panel, and represents Autodesk within the UK BIM Alliance. He sits on the buildingSMART International InfraRoom Steering Committee and is Chair of the InfraRoom Project Steering Committee that is preparing the new schemas.

## Introduction

We are in a very fortunate position today when it comes to delivering our building and infrastructure projects through their lifecycle from planning, design, construction and into operation as we can leverage a plethora of new technologies and processes to streamline, optimize and improve delivery. However this creates its own set of complications as technology is changing so quickly that it can be hard to keep up and decide what is most appropriate to use at any given time, particularly when considering the capabilities of the entire team.

Before jumping into the delivery of commitments, perhaps the most important thing to do is to take a step back, look at the challenge in front of you and make a plan on how to undertake the work. This may sound obvious but there are far too many examples of projects being delivered by 'doing it the same as my last umpteen projects', 'using the tools I am most familiar with', 'we did it the way my customer asked me to' or any number of other excuses for not planning and just hoping for the best.

When doing the planning it may only require a few key considerations to start a project with more confidence that it is achievable and all parties to understand their obligations and commitments. Following the ISO 19650 family of standards for Information Management when using BIM is highly recommended to make things simpler and to apply agreed good practice.

## Requirements

First thing to check is are there any defined Exchange Information Requirements (EIR) according to ISO 19650 principles or equivalent from your customer. Are they asking for clear deliverables by phase of work and activity that make sense and can be achieved? If not then this is a red flag to investigate further and have a conversation with your customer.

Note that unacceptable contractual requirements might be:

- simply asking for all project information
- deliver in BIM
- handover COBie (without explanation of what and when)
- project to be delivered in a file format e.g. IFC, Revit, AutoCAD, dwg, Microstation, dgn.

The request has to show a considered understanding of what is being asked for and that it relates to the project in question. Asking for BIM or files in a given format alone doesn't explain what information is needed, and simply relates to a technology preference. It's worth recognizing that generic or copied requirements are really no better than having no requirements as there will be no way to confirm that a deliverable relates to a project need; you can spot these if there is a stray reference to an unfamiliar client, project or asset.

Where customers are inexperienced or unsure of what merits specifying, this provides an opportunity for those in the supply chain or expert consultants to collaboratively develop practical and valuable requirements focussing on the data lifecycle (Figure 1). Moreover a less-is-more approach probably merits applying when developing requirements, prioritising data and information that can help decision making, can be delivered by the project teams, is checkable for correctness and completeness, is capable of being integrated and crucially identifying what will be valuable for use in the operation of the delivered assets.

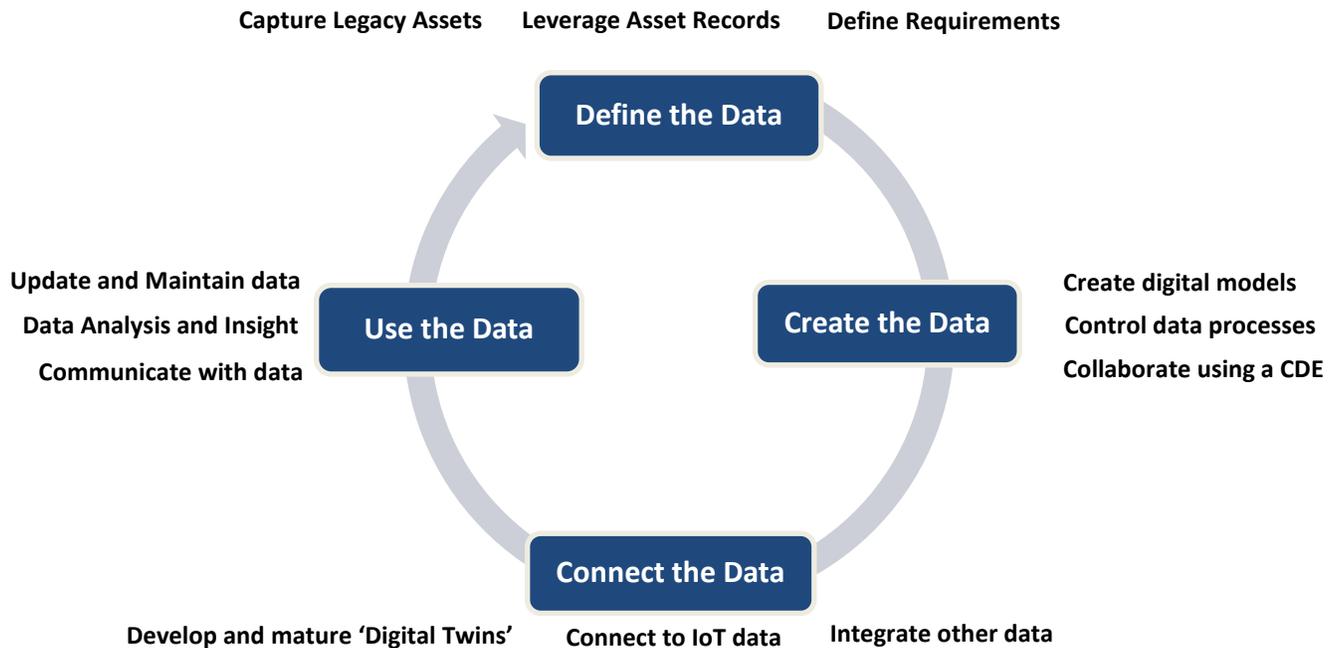


Figure 1. Asset data lifecycle and illustrative activities

## Planning

So, you have an appreciation of what is required, how do you plan which tools to use to deliver? This is perhaps the hardest aspect as it needs an understanding of aspects such as:

- What is the art of the possible and practical?
- What tools are available and what can they do?
- What skills do we have in our team, or training might we need?
- What software and versions does the project team typically use?
- How much effort is needed to deliver a defined requirement?
- Can we exchange information between different disciplines and software?

From a practical perspective it makes sense to follow a keep it simple approach and focus on ensuring priority requirements and project deliverables are met i.e. do not get distracted or trapped in trying to address unclear or complex obligations.

Where the team is uncertain on BIM or software tool capabilities many resources exist to educate or upskill designers and project managers. For example, Autodesk has a wealth of information on its website and YouTube channel related to its solutions, workflows, and good practices. Similarly, its education academy provides online courses with options for software certification online or there is a range of support options through Autodesk partners.

It is particularly important to become aware of how modelling applications are already integrated through direct or API based exchanges. These offer the easiest route to share models and data between applications and eliminate any loss through translation or other manipulation.

Similarly, scripting is increasingly being used to execute repeat laborious routine processes, embed knowledge or standard procedures, and to integrate many software applications. Autodesk Dynamo® is an example of a scripting solution that is relatively easy to learn, does not require programming skills to implement, and has an extensive set of ready to use scripts contributed by the growing community of users.

## **Platforms**

A critical aspect of achieving a successful BIM project is ensuring effective information management. ISO 19650-2:1998 provides a framework for information management during the capital phase of a built asset and identifies the key steps for the appointing party (employer) and their appointed parties (suppliers) to follow.

The common data environment (CDE) is a process to ensure information is prepared, quality checked, issued and used in a controlled and consistent approach. The CDE is best implemented using one or more linked technologies to support modellers, design team leads, project managers and all project participants to follow the process.

Using a software platform such as Forge, which powers the Autodesk Construction Cloud, provides many project management capabilities and integrates many services from third parties such as sophisticated tools for managing complex asset data requirements that are increasingly being demanded by infrastructure clients. Critically it has a core document collaboration and workflow management component that fulfils obligations needed to deploy an ISO 19650 CDE.

As project teams and asset owners become more sophisticated in their use of digital workflows a platform approach helps support data integration from multiple disciplines, introduce additional datasets, carry out complex analyses, leverage machine learning and ultimately gain more value from the asset data at all phases of the lifecycle.

## **Open Standards**

There is no universal solution for implementing BIM that can be applied to every project or asset type. This presents a challenge to the design and construction community as well as those procuring and managing built assets as they want to have some consistency and avoid starting from scratch each time. Open standards offer an opportunity to specify neutral handover formats as well as exchange format requirements.

Again, there is no one-size-fits-all open format as there are differing needs dependent on the process or discipline that is underway. Some key options for consideration:

- E57 a format for Point clouds,
- LandXML for infrastructure and linear asset exchange,
- CityGML for 3D geospatial surface representation,
- DEM for terrain data,
- CIS/2 has been in use for many years in the structural domain,
- ISO 15926 provides a framework for exchange of oil & gas elements and
- STEP ISO 10303 has been around for a long time in manufacturing
- IFC 16739-1, which is based on the same Express language as STEP

IFC or Industry Foundation Class is the most common AEC open standard and is a data model for the built environment managed and maintained by buildingSMART and their community. It has been in development for over 20 years from when Autodesk setup the Industry Alliance for Interoperability inviting 20 other vendors to work on exchange options for engineering files. This became the International Alliance for Interoperability (IAI) in 1995 and changed to buildingSMART in 2005 to better reflect its focus and be less of a mouthful.

IFC has been applied quite effectively for coordinating models and exchanging data on building projects as well as for offering a consistent handover option to owners for analysis or checking. As IFC tries to describe the entire built environment, there are understandable limitations in coverage, particularly for infrastructure, hence the InfraRoom was setup in 2013 to extend the schema to cover infrastructure and via the RailwayRoom rail assets. Autodesk has been working with a wide community of stakeholders on the preparation of these new schema extensions for many years. This new IFC 4.3 extension has recently been submitted for approval to the buildingSMART board and a project to develop new Model View Definitions (MVDs) defining exchange requirements and those for certification has recently started with a hoped for availability for use in the third quarter of 2022.

IFC and other open standards will increasingly become important as all parties, especially public owners, transition to a digital way of working. Being familiar with their suitability and use is therefore a critical part of the planning and delivery of BIM for projects and operations.

## Useful links

Although the process of understanding requirements, planning, and delivering a BIM project for infrastructure may appear daunting, hopefully this discussion has highlighted some of the key considerations and steps to take. A progressive implementation of these procedures should lead to effective adoption of BIM, improved collaboration, successful outcomes, and a positive experience from the adoption of new technologies for all involved.

Thankfully, there is also a lot of support information available, some of which has been referred to above and includes:

- Buy and download ISO 19650 [www.iso.org/standard/68078.html](http://www.iso.org/standard/68078.html)
- Guidance about ISO 19650 [www.ukbimframework.org](http://www.ukbimframework.org)
- Planning and team capability assessment guidance [www.cpic.org.uk/cpix/](http://www.cpic.org.uk/cpix/)
- Explore features of the CDE in BIM Collaborate Pro [construction.autodesk.com](http://construction.autodesk.com)
- Learn more about CDEs & Digital Twins [boards.autodesk.com/commondataenvironment](http://boards.autodesk.com/commondataenvironment)
- BIM courses available as well as certification [academy.autodesk.com](http://academy.autodesk.com)
- Find out more about Dynamo and learn how to use it [www.dynamobim.org](http://www.dynamobim.org)
- Interoperability and Autodesk support [www.autodesk.com/interoperability](http://www.autodesk.com/interoperability)
- Addons for Autodesk tools to support data requirements [interoperability.autodesk.com](http://interoperability.autodesk.com)
- buildingSMART InfraRoom [www.buildingsmart.org/standards/rooms/infrastructure](http://www.buildingsmart.org/standards/rooms/infrastructure)
- Announcement of the release of the IFC 4.3 report [www.buildingsmart.org/the-infra-and-railway-rooms-deliver-major-4-3-implementation-and-validation-report/](http://www.buildingsmart.org/the-infra-and-railway-rooms-deliver-major-4-3-implementation-and-validation-report/)