

BES500721

Single source of truth and data consistency using ACC, Revit and API

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Learning Objectives

- Understand definition, importance, challenges and benefits of single source of truth
- Learn best practices to create and maintain single source of truth using Autodesk Docs, BIM Collaborate Pro and Revit
- Go beyond the usual single source of truth implementation by exploring the innovative data compliance focused approach
- Showcase: harness ACC, Revit, API and other tools to ensure data consistency and prevent BIM Execution Plan incompliances

Description

What is a single source of truth and why it is important in the architecture, engineering, and construction (AEC) industry? In this class, we'll learn the best practices of maximizing Autodesk Construction Cloud, Autodesk BIM Collaborate Pro, Revit software, and other tools to create and maintain a single source. We'll also go beyond the usual single source of truth implementation by exploring the innovative data-focused approach to ensure data consistency and compliance achieved by combining the cloud, central project requirements repository, model authoring tools, and API automation capabilities. Regardless of whether you're involved in project planning, execution, monitoring, or closing, you'll find multiple interesting ideas, workflows, and implementation examples of using the latest technology to enhance your capabilities and achieve success.

Speaker



Mateusz Lukasiewicz, Digital Projects Analyst at KEO International Consultants based in Dubai (UAE) has over 12 years of experience in the AEC industry, and throughout his career, he successfully led digital services on large-scale projects delivering several advanced digital engineering solutions for globally renowned firms.

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Expertise:

- Building Information Modelling
- Computer Programming
- Project Management

Education:

- B.Sc. Structural Engineering
- M.Sc. Construction Management and Engineering

Certifications:

- PMI Project Management Professional PMP
- BSI BIM Project Information Professional



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of planning, design or project delivery in the built and natural environments. For over 57 years we've led with vision, contributing to many of the world's most ambitious projects, iconic places, remarkable experiences and prosperous communities.

KEO is a highly integrated and agile AEP/PMCM firm, ranked by ENR in the Top 225 International Design Firms; in the Top 20 International PM/CM Firms; and by World Architecture as 50th largest global architecture firm and #1 Firm in the Middle East Region in their 2021 WAS 100 Survey.

KEO is continually pursuing innovations that will crystallize the client's vision by promoting design excellence, high standards, and delivery quality and using experience and expertise to resolve complexity and realize opportunity. BIM and digital design engineering are our standard ways of delivering projects.

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Understand definition, importance, challenges and benefits of single source of truth.

Why does data quality matter?

In construction, decisions are usually made in an environment where some amount of data is available to consider. But all too frequently, that data is not easily accessible for quick decisions, or even worse, the available data is incorrect. Across the globe, the ability to utilize data in an insightful manner is no longer a nice-to-have, it has become a primary source of competitive advantage. Those who utilize their data to make informed decisions and gain performance insights from it will ultimately emerge as leaders in construction. The research shows that adopting a data strategy can eliminate many avoidable costs in construction, both direct and indirect. It's clear that making decisions using "good" data can propel an organization to a higher level of performance. Fortunately, the future Executive Summary for a data-driven construction industry is bright—with many industry leaders identifying that hiring employees with data management skills is now a core component of their operating model

Infographic below (*Harnessing the data advantage in construction, Autodesk, 2021*) shows high level estimate of the cost of bad data in 2020, although, the numbers are indicative only, it is clear that construction industry is facing significant problem with the quality of data.

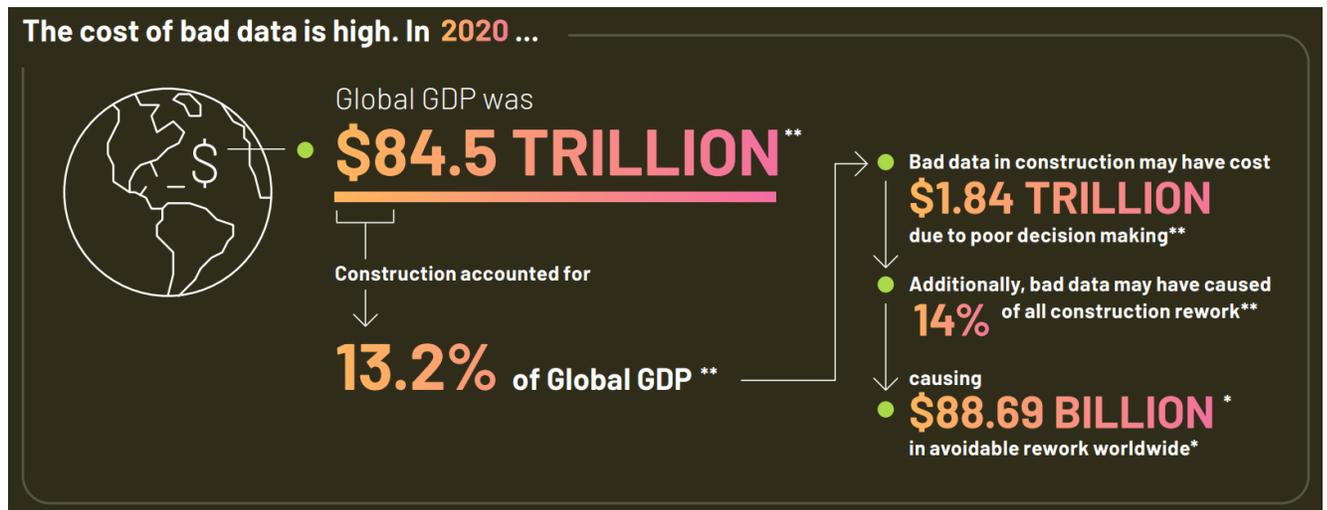


FIGURE 1 COST OF BAD DATA IN 2020

Single Source of Truth definition

Technical definition:

Single source of truth (SSOT) is the structuring of information models and associated data schema such that every data element is stored exactly once. Linkages to this data element are by reference only. Any updates in the primary location data element propagate to the entire system without the possibility of duplicate values. This behavior can be observed in Autodesk Revit models, where single change in model element (example: wall thickness) affects associated views, schedules, volumetric data and tags. Another example is change in Revit family type parameters, where single change propagates to all instances of this family and type in the model.

Plain language definition:

Single source of truth (SSOT) is a concept used to ensure that everyone in an organization bases business decisions on the same data. Creating a single source of truth is straightforward. To put an SSOT in place, an organization must provide relevant personnel with one source that stores the data points they need. The simplest example of SSOT implementation in construction project is Common Data Environment Shared Area data used by project stakeholders.

Benefits, qualities and challenges

Single Source of Truth benefits:

-  Reduce mistakes, errors and rework
-  Help teams meet schedules/budgets
-  Improve communication and the quality of construction
-  Achieve better decision making
-  Improve trust and transparency on the whole
-  Reduce risk and fear of moving forward with the wrong information

Single Source of Truth qualities:

- Accessibility
- Up to date
- Standardized
- Integration
- Trusted
- Empowers informed decisions

Learn best practices to create and maintain single source of truth using Autodesk Docs, BIM Collaborate Pro and Revit.

Use ACC as Common Data Environment (CDE) and apply ISO-19650 folder structure

The common data environment (CDE), is the single source of information used to collect, manage and disseminate documentation, the graphical model and non-graphical data for the whole project team.

On the left, there is a simplified view of how team members typically exchange information on a project. It is a complex matrix, and it is challenge to ensure the right information is with the right person at the right time. Often information is stored within different systems. and information exchange is manual, error prone, and can lead to costly mistakes.

On the right, a CDE has been adopted by the project team. With a CDE, the information flows through a central repository where, ideally, it is more easily controlled and up to date. The CDE provides mechanisms to gate information flow so that construction documents (and other information such as markups and issues) are only available to project team members when the information has been reviewed, approved, and release for its intended purpose

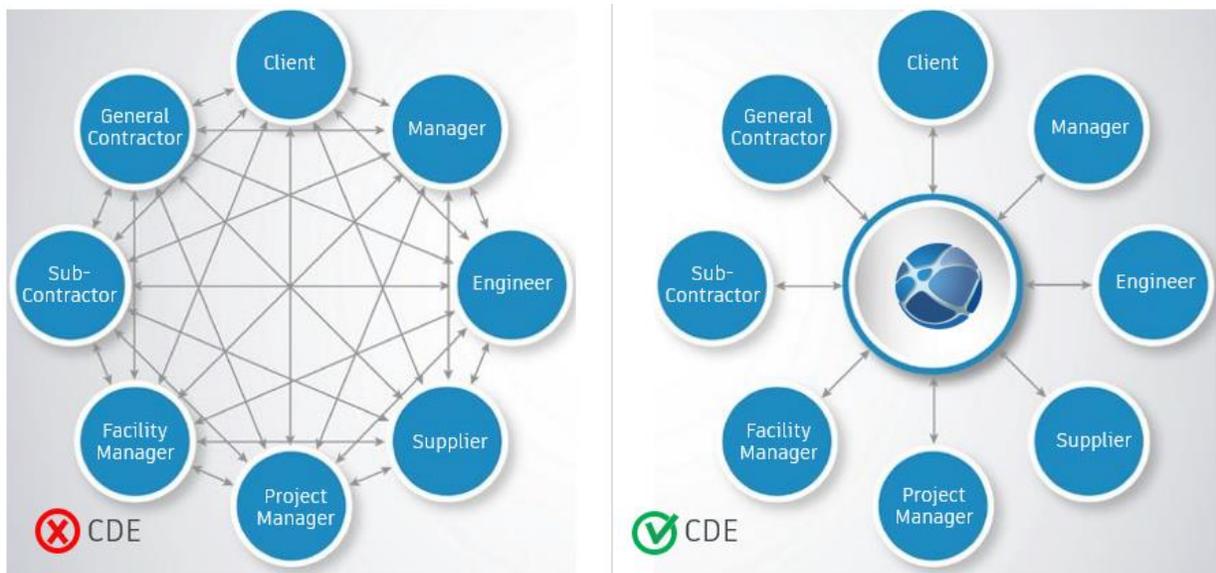


FIGURE 2 CDE

ISO 19650 is an international standard for end-to-end information management over the lifecycle of a built asset. It provides clear definitions for the information needed by the project client or asset owner and for the methods, processes, deadlines for the efficient and effective transfers of information between project team members.

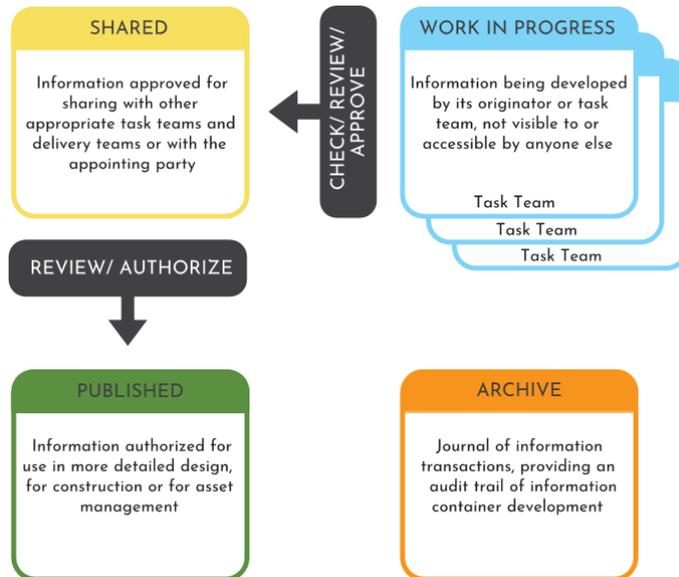


Figure 3 ISO 19650 information state

Autodesk Construction Cloud functionality and flexibility allows creating ISO-19650 compliant, permissions controlled CDE.

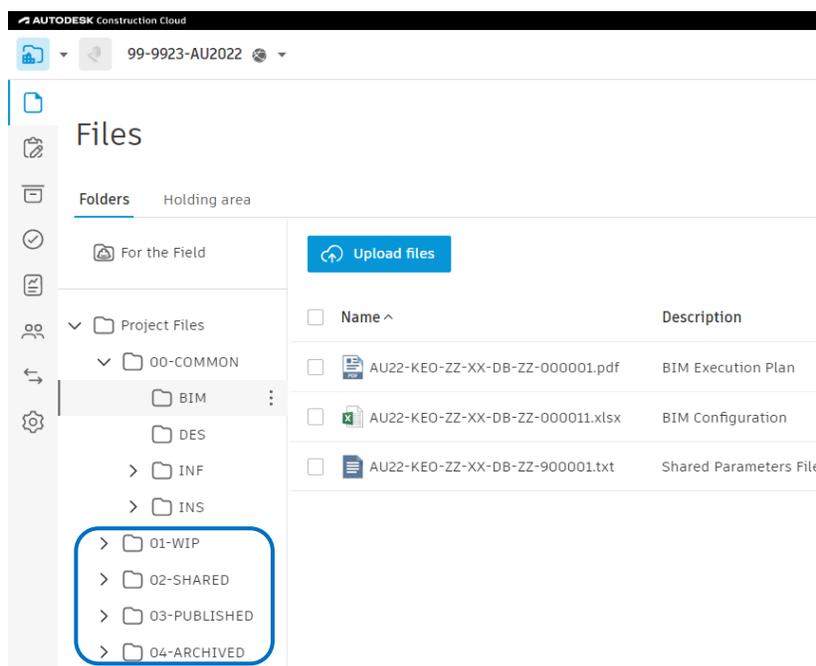


FIGURE 4 AUTODESK CONSTRUCTION CLOUD CDE

Worksharing (central and local models)

Revit worksharing is a design method that allows multiple team members to work on the same project file at the same time. Revit projects can be subdivided into worksets to accommodate such environments. You can enable worksharing by creating a central model so that team members can simultaneously make design changes to a local copy of the central model.

Worksharing can be enabled on local machine, server on premises or in Autodesk Construction Cloud/BIM360 using BIM Collaborate Pro cloud worksharing functionality.

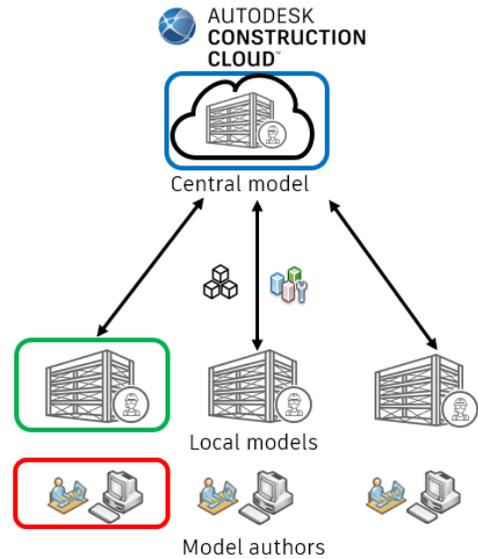


FIGURE 5 REVIT WORKSHARING

Name	Version	Size	Last updated	Updated by
03-NWF-NWD	--	--	Jul 7, 2022 2:02 PM	AS ACC system
04-IMG-VID	--	--	Jul 7, 2022 2:02 PM	AS ACC system
10-AUTHORITY	--	--	Jul 7, 2022 2:02 PM	AS ACC system
published central model				2 PM AS ACC system
published central model				2 PM AS ACC system
AU22-KE0-ZZ-XX-M3-ST-000001.rvt	V2	18.1 MB	Jul 19, 2022 2:58 PM	Mateusz Lukasiewicz

AUTODESK FORGE [GET https://developer.api.autodesk.com/data/v1/projects/:project_id/folders/:folder_id/contents](https://developer.api.autodesk.com/data/v1/projects/:project_id/folders/:folder_id/contents)
"modelGuid": "112c5597-d6e8-4a66-8b13-e2197192bdc9"

FIGURE 6 MODEL GUID

Share models using Design Collaboration

Design Collaboration (BIM Collaborate Pro) is a ACC module that improves multi-firm project teams' ability to meet the demands of a modern construction project. Based on this diversity, Design Collaboration allows teams to choose how they work with other teams. Sometimes they need to be constantly in sync, while in other cases they need to control the exchange of information between each other. With constant development of the project BIMs, spanning multiple teams in different parts of the world, Design Collaboration also provides a crucial common view of the project.

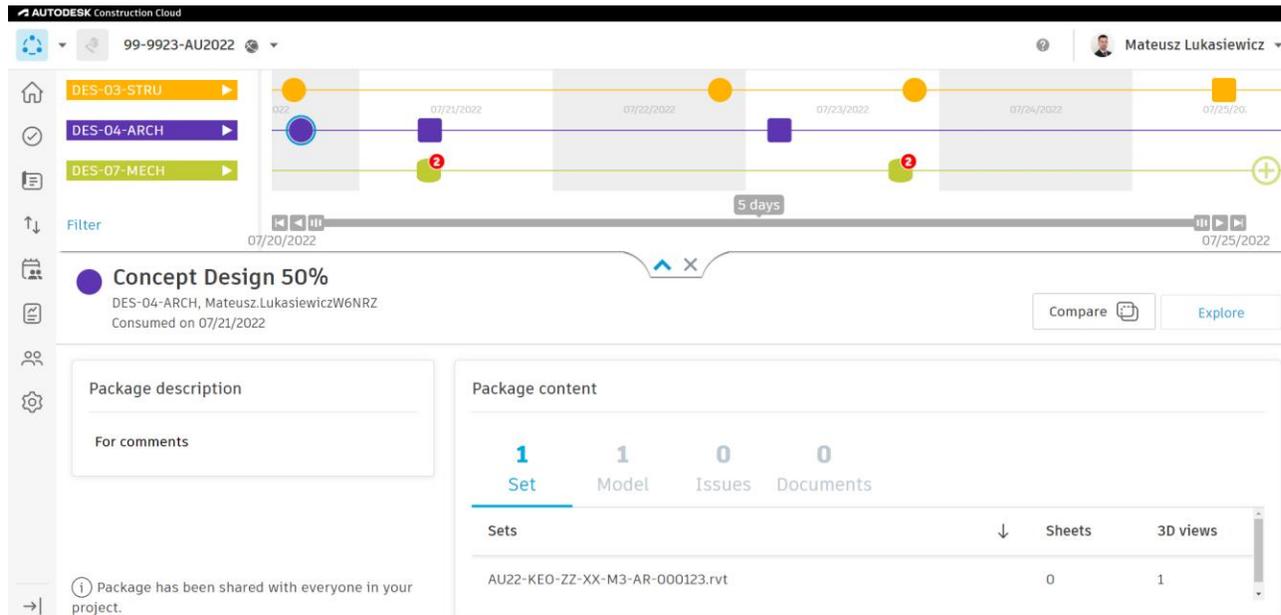


FIGURE 7 DESIGN COLLABORATION DATA EXCHANGE

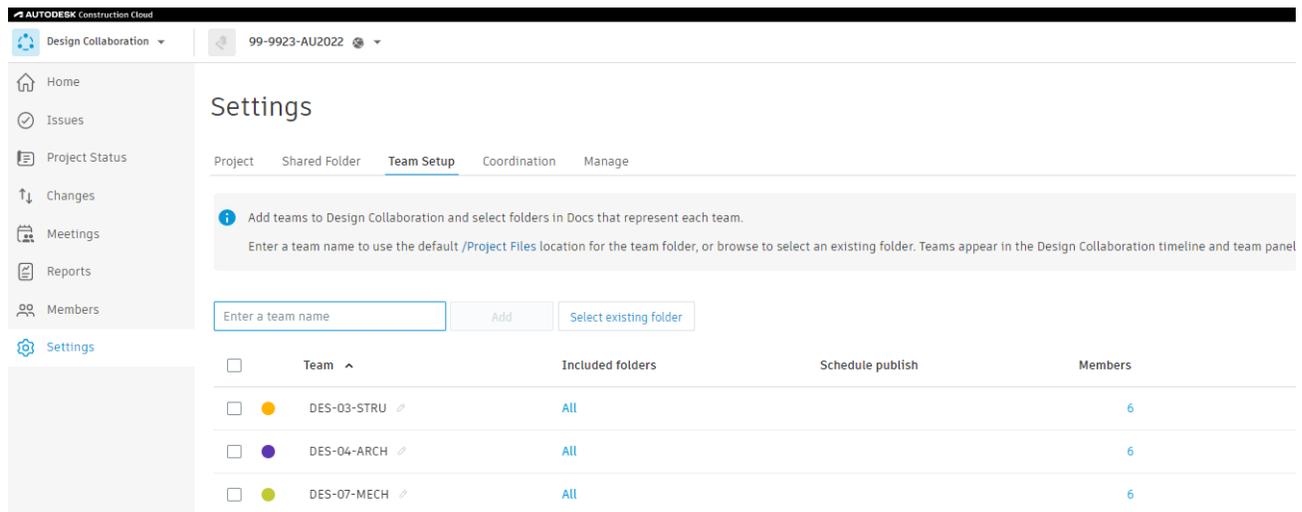


FIGURE 8 DESIGN COLLABORATION TEAMS

Centralize project requirements and execution data

Highly recommended practice is to store project requirements data in the common, accessible location to avoid superseded versions being used by the project team. In the context of project execution these files may include:

- BIM Execution Plan
- Shared Parameters file
- BIM Configuration/Structured Data Requirements (please refer to next section and video recording for more details).

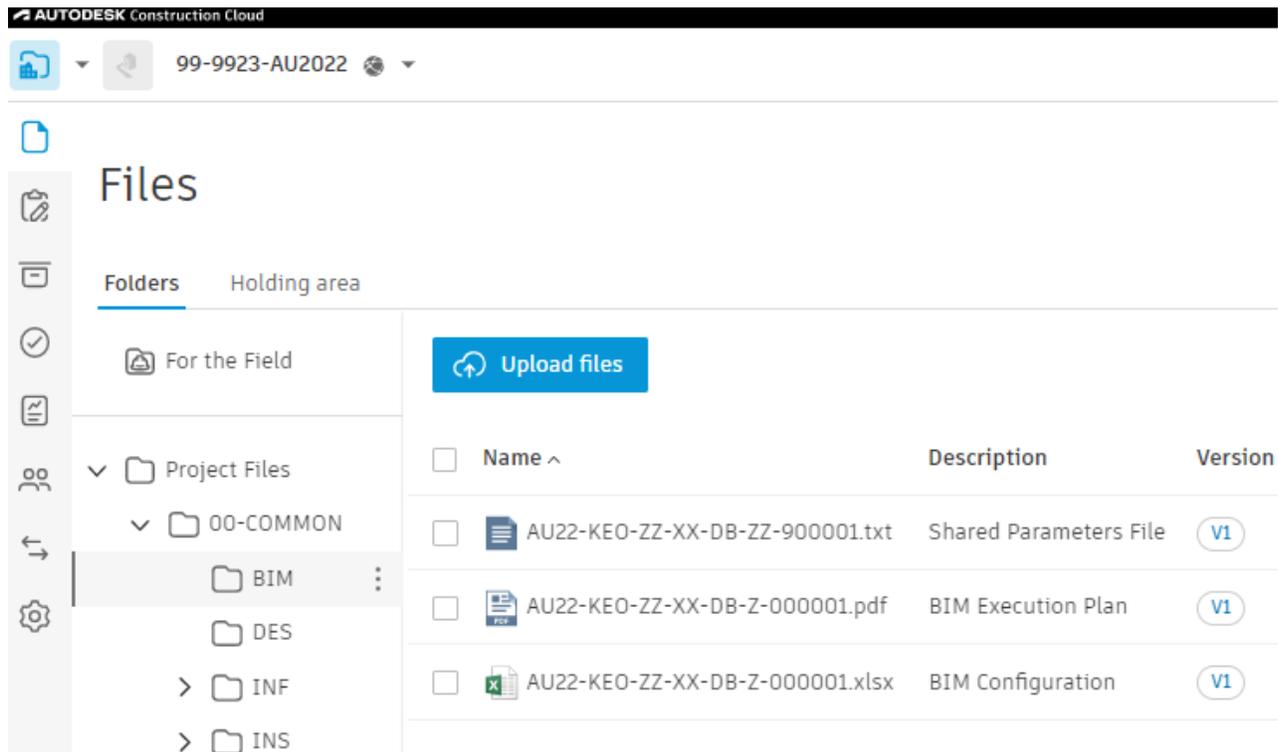


FIGURE 9 PROJECT REQUIREMENTS LOCATION

The Parameters Service (currently under technical preview) available in Autodesk Revit 2023 is an alternative to using .txt shared parameter file. The Parameters Service allows to manage parameters library using Autodesk Construction Cloud. By using the Parameters Service, parameters can be searched and pulled in bulk into Revit model. All Parameters are integrated directly into Autodesk Construction Cloud.

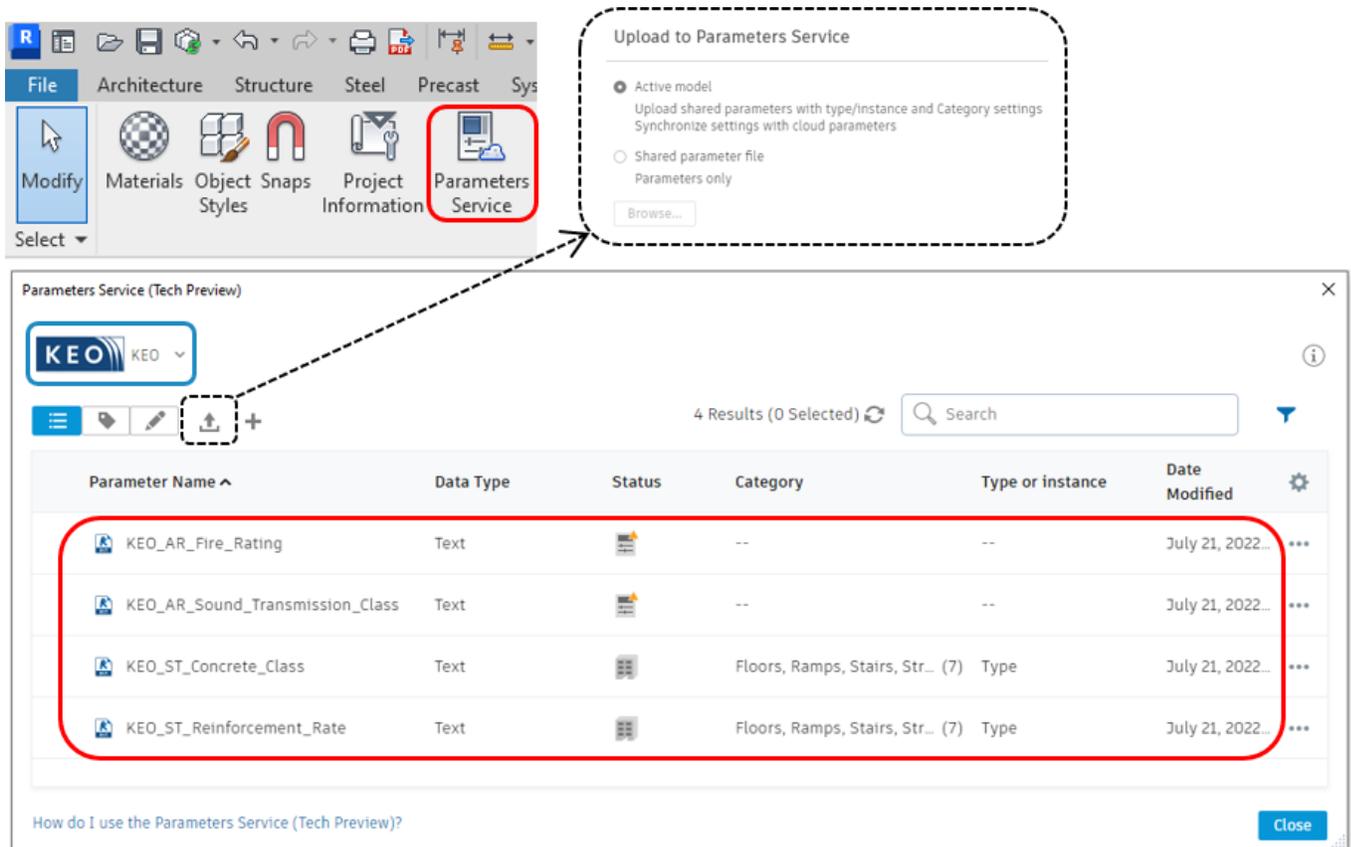


FIGURE 10 REVIT PARAMETERS SERVICE

Use other built-in tools to leverage data in ACC

Autodesk Construction Cloud™ is a cloud-based construction management and collaboration solution. The following offerings are available on the Autodesk Construction Cloud™ platform:

- [Autodesk® Build](#)
- [Autodesk® BIM Collaborate](#)
- [Autodesk® Takeoff](#)
- [Autodesk® Docs](#)

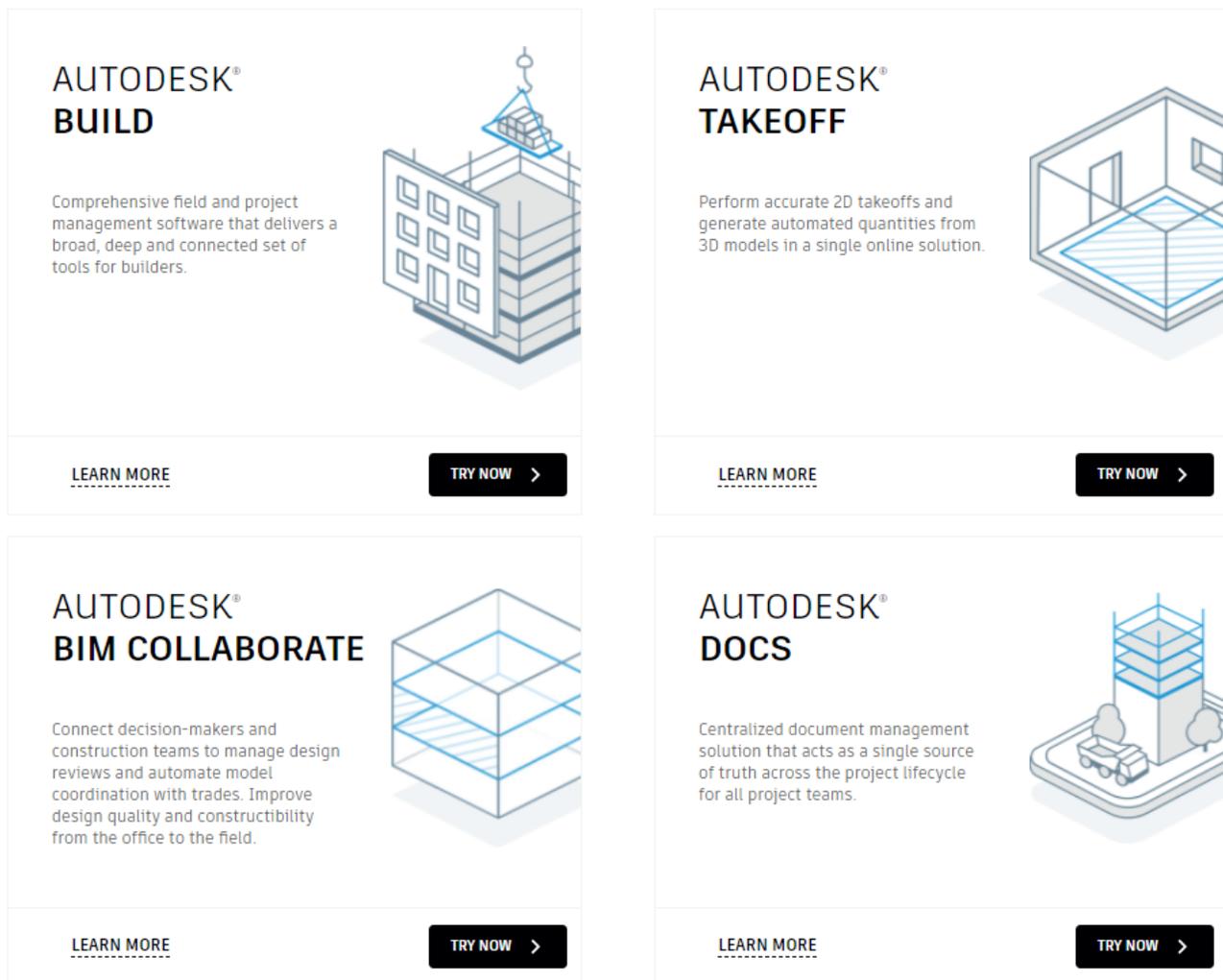


FIGURE 11 AUTODESK CONSTRUCTION CLOUD OFFERINGS

Each module contains set of tools dedicated to specific tasks during the project execution. Please refer to [Courses \(autodesk.com\)](https://www.autodesk.com/courses) for detailed functionality demonstration and training course for each tool.

Go beyond the usual single source of truth implementation by exploring the innovative data compliance focused approach.

Tools

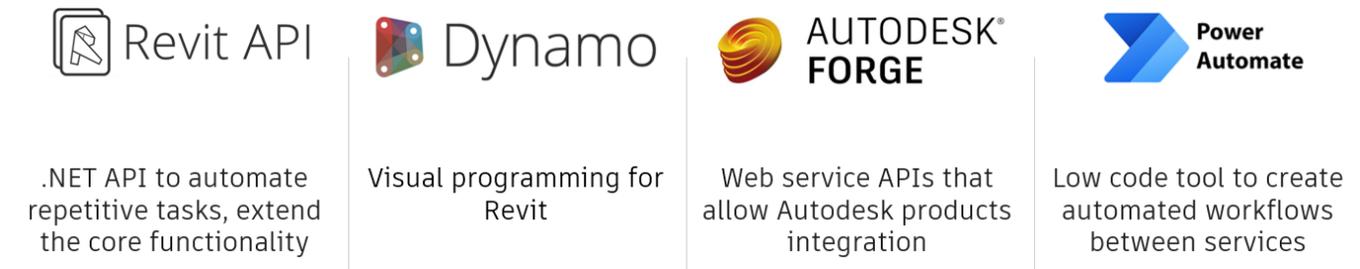


FIGURE 12 COMMON AUTOMATION TOOLS

Revit API:

.NET API which can be used to automate repetitive tasks, extend the core functionality of Revit in simulation, conceptual design, construction and building management, and much more. Revit .NET API allows you to program with any .NET compliant language including VB.NET, C#, and C++/CLI.

[Revit API Docs](#)

Dynamo:

Programming environment that requires no programming experience. Dynamo enables designers to create visual logic so they can explore a wide range of parametric conceptual designs using logic, simple data and analysis without the need to create a physical prototype. Dynamo also automates repetitive design tasks so designers can use their productive time more wisely.

[Learn - Dynamo BIM](#)

Autodesk Forge:

The Forge Platform offers APIs and services that help you access and use your design and engineering data via the cloud.

[Autodesk Forge](#)

Power Automate:

Cloud-based service that allows users to create workflows themselves to automate recurring routine tasks and processes in different programs / services.

[Power Automate | Microsoft Power Platform](#)

Going beyond

Typically, automation tools for Autodesk Revit are executed by user intentionally (on-click) inside model authoring software. The most common examples will be Revit Add-In executed from UI and Dynamo Scripts run from Dynamo Player.

 Environment	 Execution type	 Scope	 User awareness
Inside model authoring software	On click	Read Write Edit	Aware

FIGURE 13 COMMON AUTOMATION TOOLS EXECUTION

Alternative ways allow automation tools to run silently without user interaction not only inside but also outside Revit environment. Examples are Revit plugs-in executed on events and Forge API based applications.

 Environment	 Execution type	 Scope	 User awareness
Inside model authoring software Outside model authoring software	On click Scheduled On event	Read Write Edit	Aware Alerted on non-compliance Unaware (silent)

FIGURE 14 ALTERNATE WAYS OF AUTOMATION TOOLS EXECUTION

Using advanced concepts below open new opportunities of assuring data consistency and project requirements compliance.

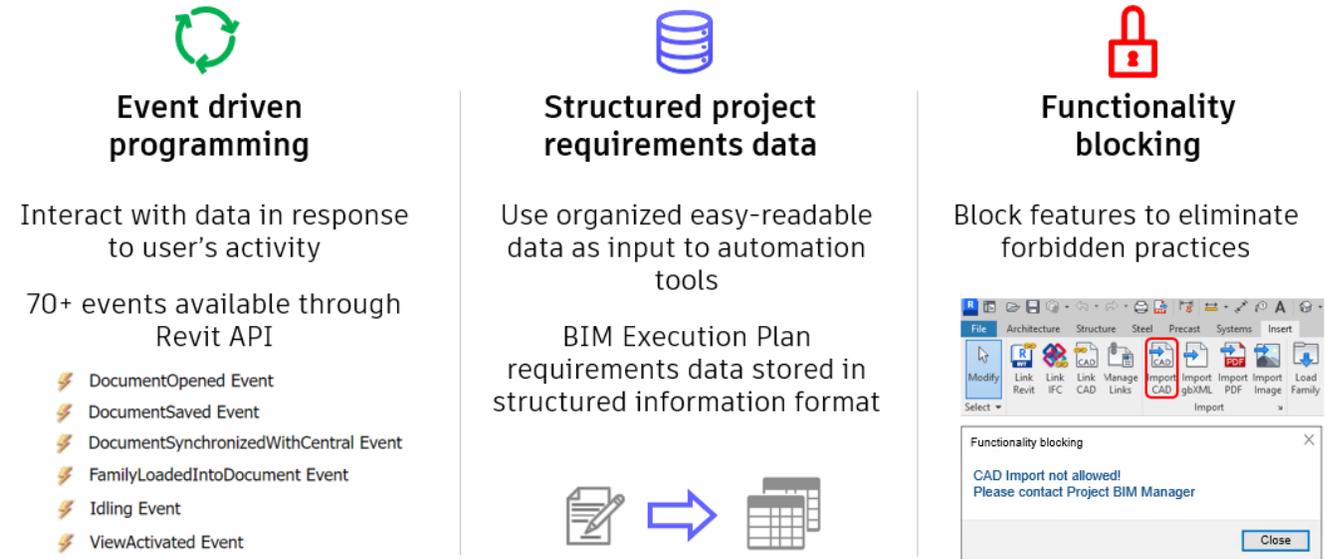


FIGURE 15 METHODS USED IN SHOWCASE

Event-driven programming:

Programming paradigm in which the flow of the program is determined by events such as user actions (mouse clicks, key presses), sensor outputs, or message passing from other programs or threads. There are more than 70 Event available in Revit API that can be subscribed for and used to trigger an action.

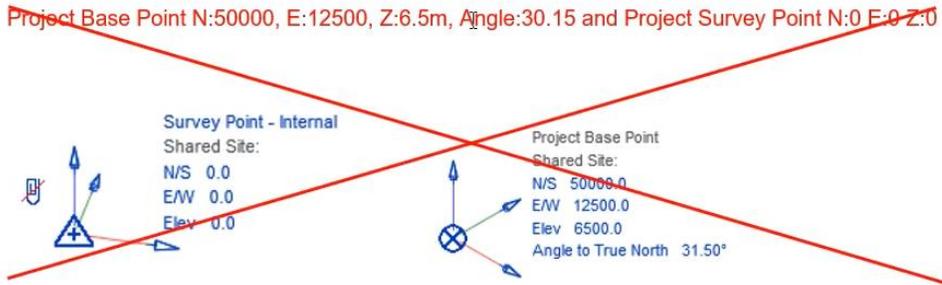
Structured project requirements data:

Structured data is when data is in a standardized format, has a well-defined structure, complies to a data model, follows a persistent order, and is easily accessed by humans and programs. This data type is generally stored in a database.

- Has an identifiable structure that conforms to a data model
- Is presented in rows and columns, such as in a database
- Is organized so that the definition, format and meaning of the data is explicitly understood
- Is in fixed fields in a file or record
- Has similar groups of data clustered together in classes
- Data points in the same group have the same attributes
- Information is easy to access and query for humans and other programs
- Elements are able to be addressed, enabling efficient analysis and processing

Below is an example of unstructured project location data (survey and base point coordinates) captured in BIM Execution Plan as plain text and image, which is replaced with structured data stored in the table.

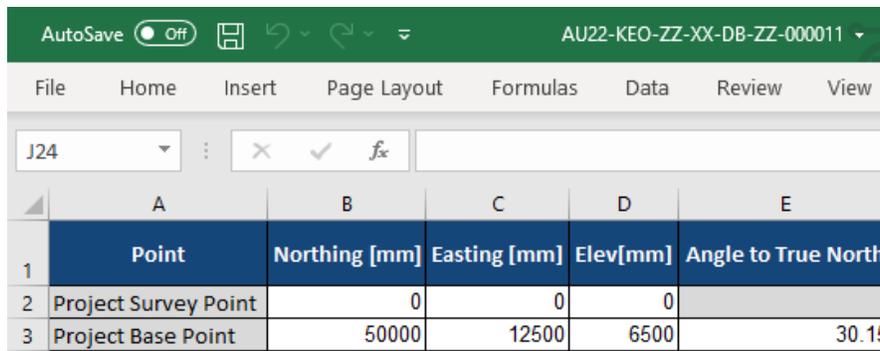
Replace unstructured data...



...with reference to configuration file containing structured data

Refer to [AU22-KEO-ZZ-XX-DB-ZZ-000011.xlsx](#) BIM Configuration File for base and survey point coordinates

FIGURE 16 UNSTRUCTURED DATA IN BEP



	A	B	C	D	E
1	Point	Northing [mm]	Easting [mm]	Elev[mm]	Angle to True North
2	Project Survey Point	0	0	0	
3	Project Base Point	50000	12500	6500	30.15

FIGURE 17 STRUCTURED DATA

Functionality blocking:

Revit built-in commands functionality can be overridden to perform other actions. This concept can be used to block unwanted forbidden functionality (example: CAD Import) to prevent bad modelling practices and ensure project requirements compliances.

Showcase: harness ACC, Revit, API and other tools to ensure data consistency and prevent BIM Execution Plan incompliances.

Refer to session's video recording for project environment, requirements, models, plug-ins and custom integrations setup, Revit and Forge API examples.

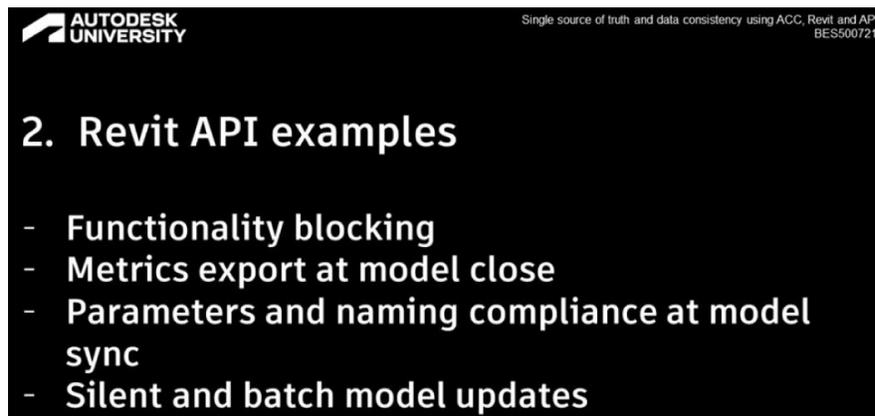


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1. Setup

- Autodesk Construction Cloud project
- Revit plug-ins
- Forge application
- Revit cloud worksharing
- BEP to structured information
- Revit parameters service

Figure 18 Showcase video 1

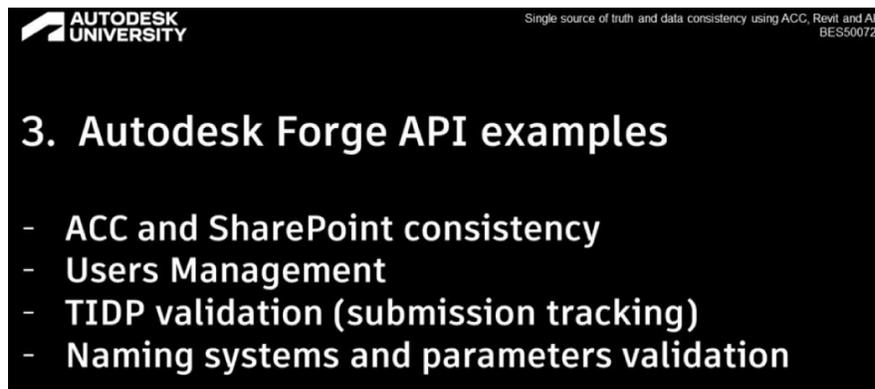


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2. Revit API examples

- Functionality blocking
- Metrics export at model close
- Parameters and naming compliance at model sync
- Silent and batch model updates

Figure 19 Showcase video 2



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3. Autodesk Forge API examples

- ACC and SharePoint consistency
- Users Management
- TIDP validation (submission tracking)
- Naming systems and parameters validation

Figure 20 Showcase video 3

Resources:

[Harnessing the Data Advantage in Construction \(autodesk.com\)](#)

[What Is a Single Source of Truth \(SSOT\)? | Vista Projects](#)

<https://www.informationweek.com/it-leadership/how-to-get-one-version-of-the-truth/d/d-id/1101181>

[SSOT: Why Everyone in Construction Should Care About this Acronym \(autodesk.com\)](#)

[ISO 19650, the Common Data Environment, and Autodesk Construction Cloud | by Autodesk University | Autodesk University | Medium](#)

[Revit API Docs](#)

[Learn - Dynamo BIM](#)

[Autodesk Forge](#)

[Power Automate | Microsoft Power Platform](#)

[What is Structured Data? | TIBCO Software](#)