AUTODESK UNIVERSITY

IFC in Autodesk – The Next Generation

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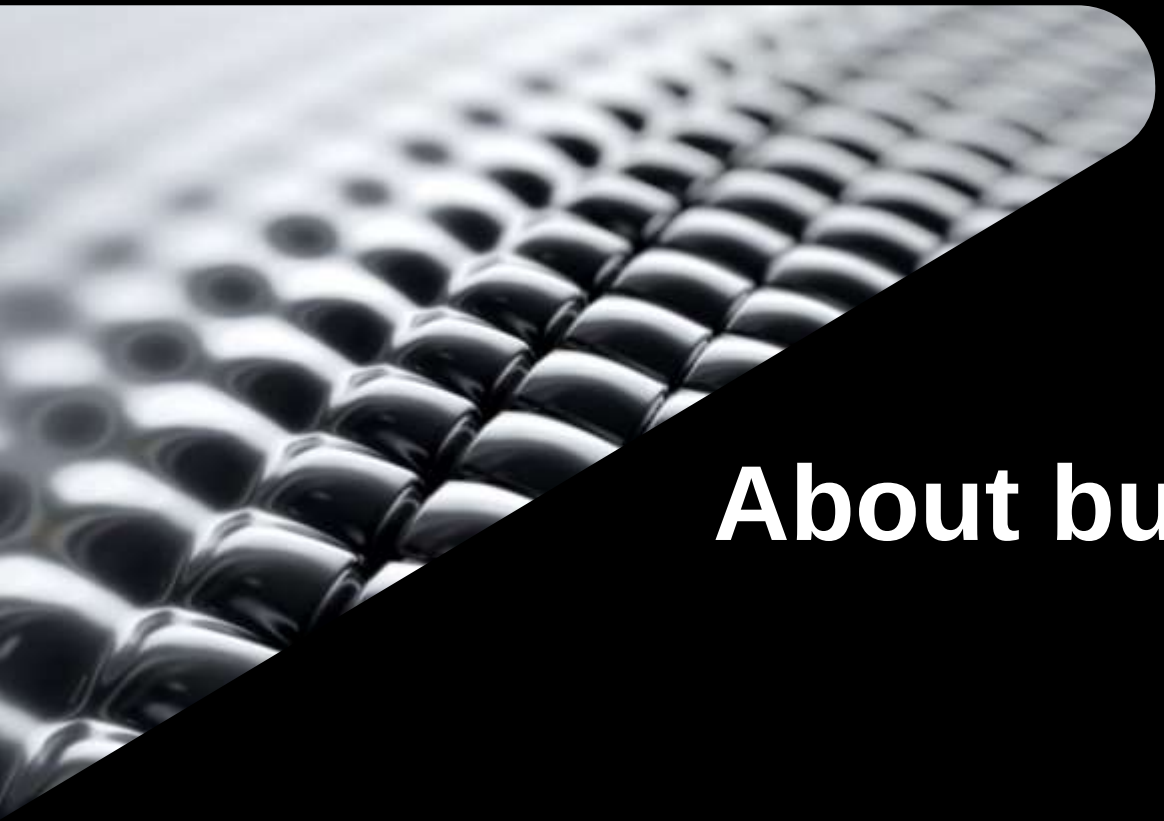


About buildingSMART

And what is an IFC?

Autodesk and buildingSMART International

1994 – Autodesk creates the Industry Alliance for Interoperability
1996 – renamed as International Alliance for Interoperability (IAI)
1997 – IFC 1.0 released
1999 – IFC 2.0 released
2003 – IFC 2x2 released
2005 – IAI renamed buildingSMART
2005 – IFC 2x3 released
2013 – IFC 4 released
2018 – IFC 4.1 (alignment) released
2022 – IFC 4.3 released

What is an IFC?

IFC = Industry Foundation Class

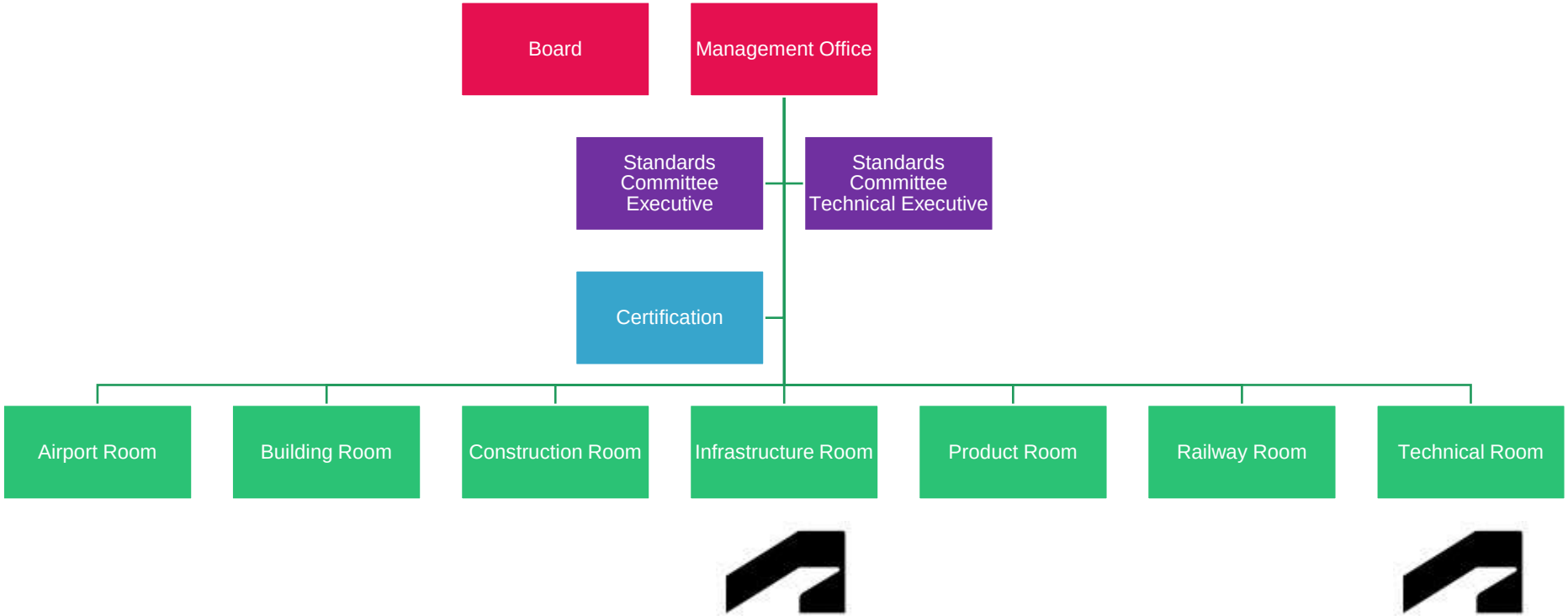
What is IFC? https://youtu.be/9YgXXbdohOQ

- an object-based data model for AEC data
- an open file format specification
- managed by buildingSMART International and its members
- 3 components for a valid IFC file: IFC Schema, IFC version, specified Model View Definition (MVD)

```
MarineFacility : #24= IFCMARINEFACILITY('3$5w3Zy350we3TL1yH_jcd',$,'Sydney Ferries',$,$,#28,$,$,$,.NOTDEFINED.);
  ReferencesElements : #76= IFCFACILITYPART('2rZAYplcf7Hu4GBw_FfuTH',$,'Circular Quay',$,$,#77,$,$,$,IFCMARINEPARTTYPEENUM(.BERTHINGSTRUCTURE.),.NOTDEFINE
    Placement : #77= IFCLOCALPLACEMENT(#46,#5);
    Decomposes : #43= IFCFACILITY('3qeyM8bFXEhx3chC2j5L4z',$,'Circular Quay Interchange',$,$,#46,$,$,$);
    HasAssociations : #78= IFCCLASSIFICATIONREFERENCE($,'En_80_70','Marine and waterways transport entities',#73,$,$);
  Placement : #28= IFCLOCALPLACEMENT(#23,#5);
  HasAssociations : #55= IFCCLASSIFICATIONREFERENCE($,'Co_80_70','Marine and waterways transport complexes',#51,$,$);
```

- uses an ASCII (human readable) file format
- an official International Standard ISO 16739-1:2018

buildingSMART International Structure



buildingSMART Strategic Advisory Council

SAC is the most senior form of organizational membership in buildingSMART

ARUP

AUTODESK

CCCC
CHINA COMMUNICATIONS CONSTRUCTION COMPANY

RBIM 铁路BIM联盟
China Railway BIM Alliance

NEMETSCHEK
GROUP®

ORACLE
Construction
and Engineering

Schneider
Electric

SIEMENS
Ingenuity for life

Trimble

buildingSMART International Chapters

Full Chapters:

- Benelux
- Canada
- China
- Denmark
- Finland
- France
- Germany
- Japan
- Norway
- Russia
- South Korea
- Switzerland
- Sweden
- UK and Ireland

Developing Chapters

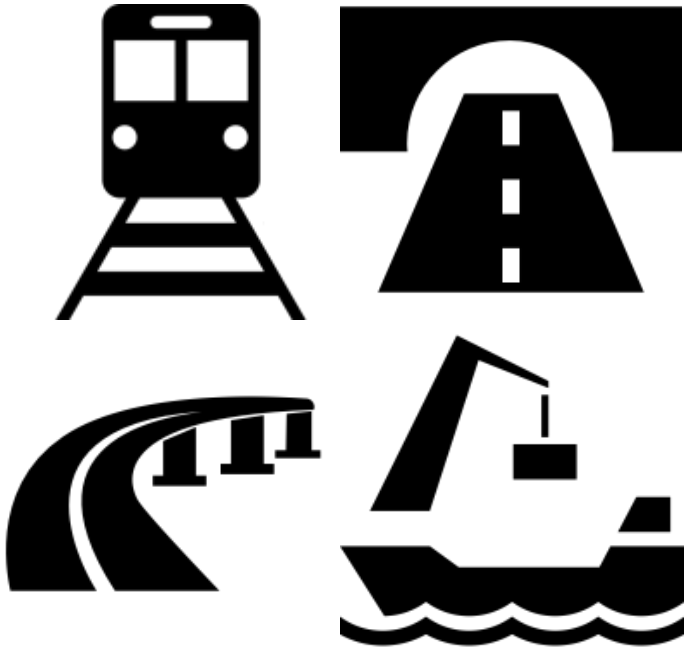
- Austria
- Australasia
- Hong Kong
- Italy
- Poland
- Spain
- Turkey
- Singapore

InfraRoom Mission & Scope

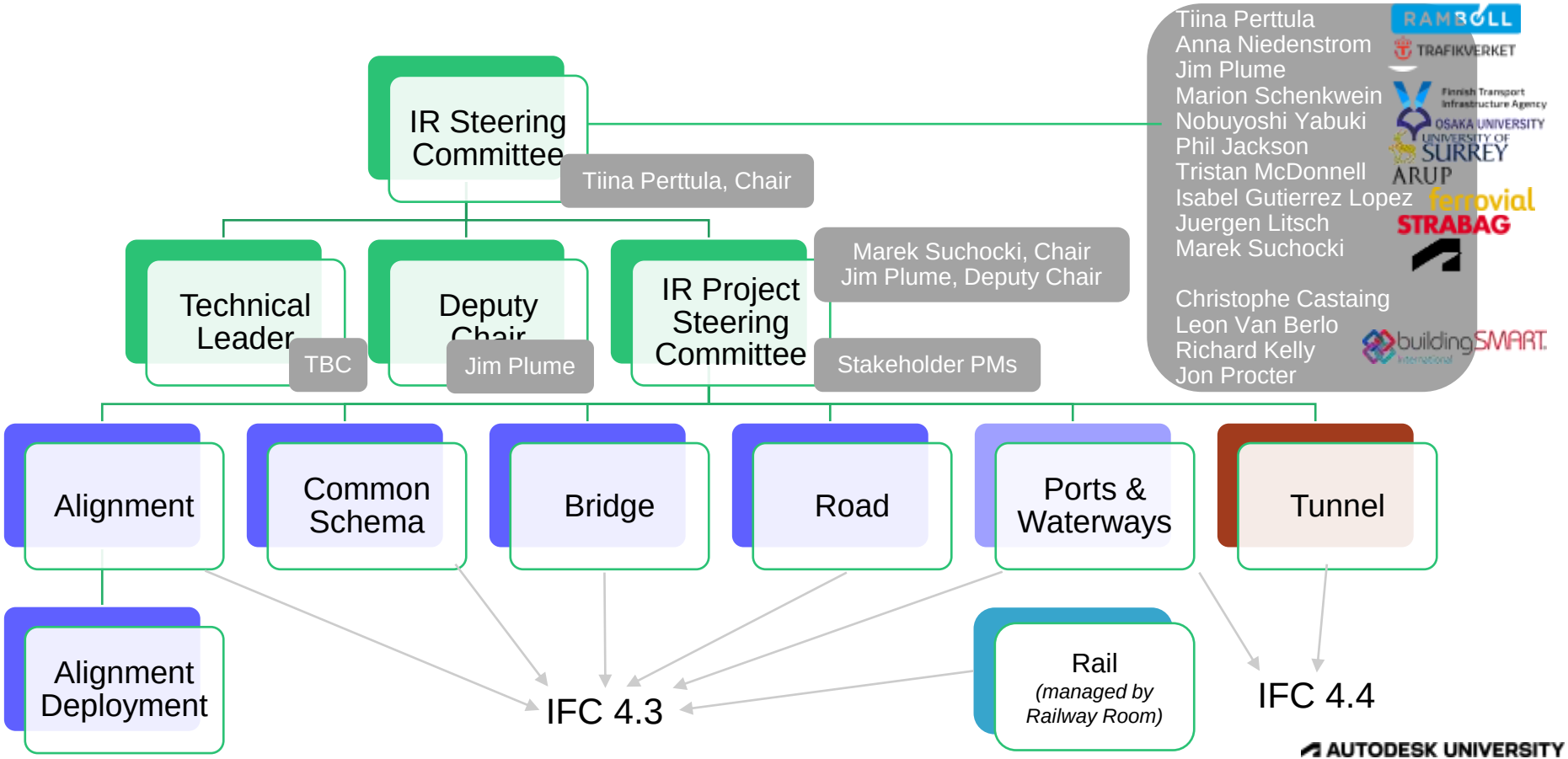
Established in 2013 to address lack of infrastructure support in IFC data model

Mission: To combine, enhance and develop open standards for intelligent data, which enable process and data integration for Infrastructure

Scope: Information exchange and process standards to support effective management of constructed built environment & linking and integrating across BIM and GIS.

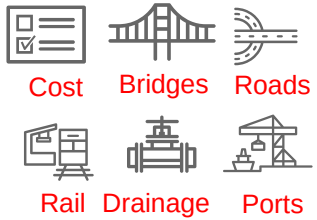


Infrastructure Room



Organisations providing scenarios

IFC 4.3 Infrastructure Extensions programme



Statens vegvesen
Norwegian Public Roads Administration

INDIANA DEPARTMENT OF TRANSPORTATION

LOGAN
CITY COUNCIL

MND

VIANOVA
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Trafikledsverket

HNTB

EIC
ACTIVITIES

COWI

TRAFIKVERKET

Royal HaskoningDHV
Enhancing Society Together

WSV.de
Wasserstraßen- und Schifffahrtsverwaltung des Bundes

HSR
HOCHSCHULE FÜR TECHNIK
RAPPERSWIL

Organisations providing scenarios

IFC 4.3 Railway programme

Example infrastructure Model View Definitions (MVD)

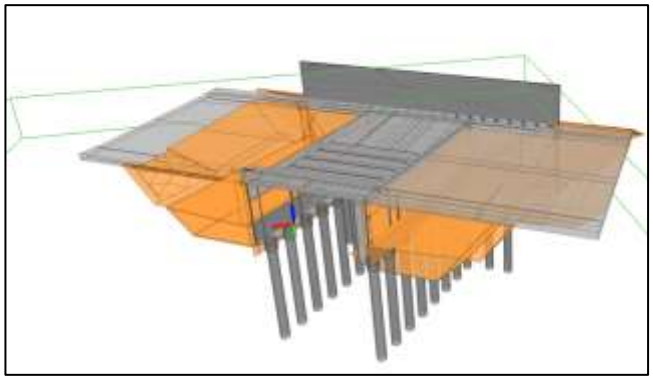
Reference View

BRep geometry

Component placement in project coordinate system (XYZ)

→ *coordinate-based approach*

Leverage new IFC classes e.g. *IfcBridge, IfcBridgePart, IfcBearing*



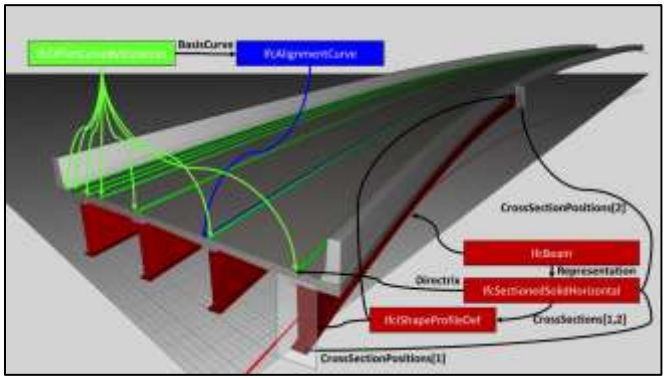
Alignment-based Reference View

BRep geometry

Component Placement relative to a given *IfcAlignment* curve

→ *alignment-based approach*

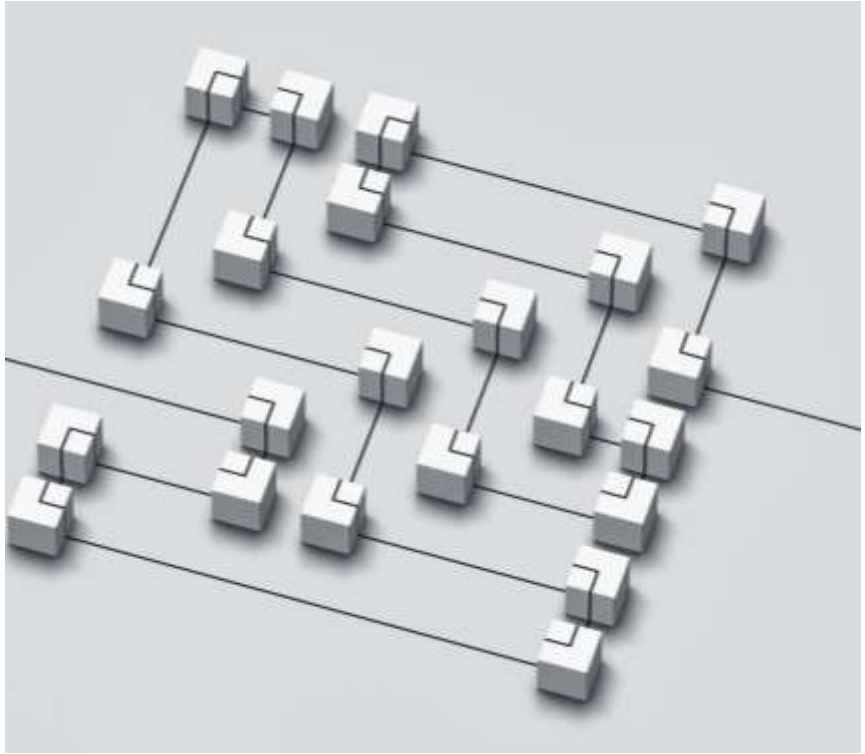
Leverage new IFC classes e.g. *IfcBridge, IfcBridgePart, IfcBearing, IfcSectionedSolidHorizontal, …* ***+ IfcAlignment***

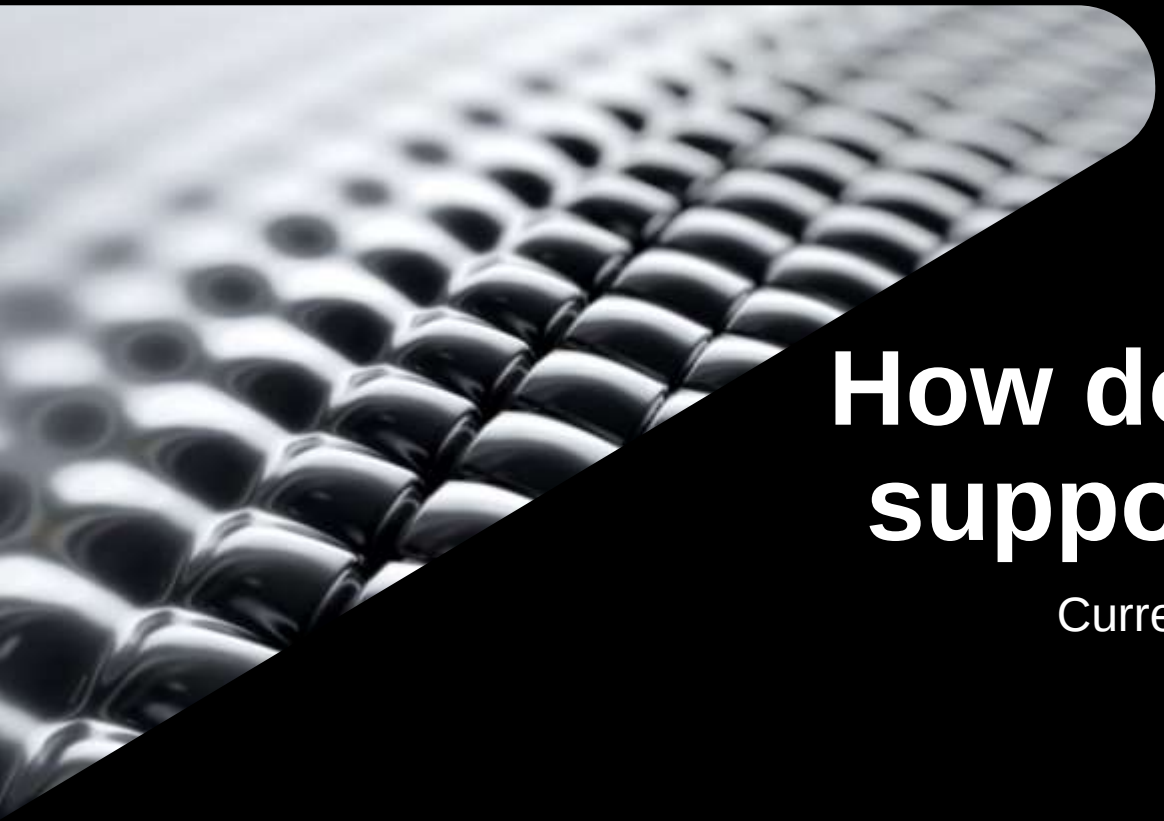


Source: Sebastian Esser TUM

IFC 4.3 MVD for Certification

- The project provides the following base MVDs:
  - Reference View
  - Alignment Based Reference View
  - Design Transfer View
  - Other custom Views
- Will provide necessary information to start software certification through MVDs
  - Formal software certifications are expected *to commence* in Q3 2022
- Work undertaken in collaboration with AASHTO, who will include an IFC 4.3 Bridge MVD as handover specification to US supply chain



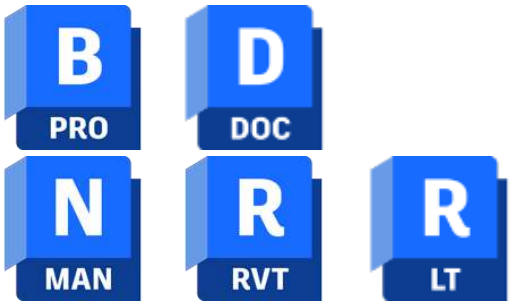


How does Autodesk support IFC today?

Current product IFC implementations

Autodesk IFC Support

Support for IFC 2.3 in 14 Autodesk solutions.



IFC4.1 Alignment

IFC Vision | Concepts

CONSISTENT

Geometries and properties are consistently authored and consumed when exchanging data between partners utilizing IFC formats with high fidelity.

PERFORMANT

The time experienced for reading and authoring data exchanged via IFC is reasonable.

FLEXIBLE

Supports unique project requirements and goals through flexibility in how data is defined and understood when exchanged via IFC.

IFC Certified Versions in Autodesk Products

IFC 4 → RVT

Reference View 1.2 export: Architecture/Structure/MEP
Reference View 1.2 import: in progress

incorporates several extensions of IFC in building, building services and structural areas, enhancements of geometry and other resource components, and numerous quality improvements.

IFC 2x3 → RVT LT ARC

Coordination View 2.0 export: Architecture/Structure/MEP
Coordination View 2.0 import

most commonly used format at the moment and supported by most BIM applications

IFC 2x2 → RVT

CORENET

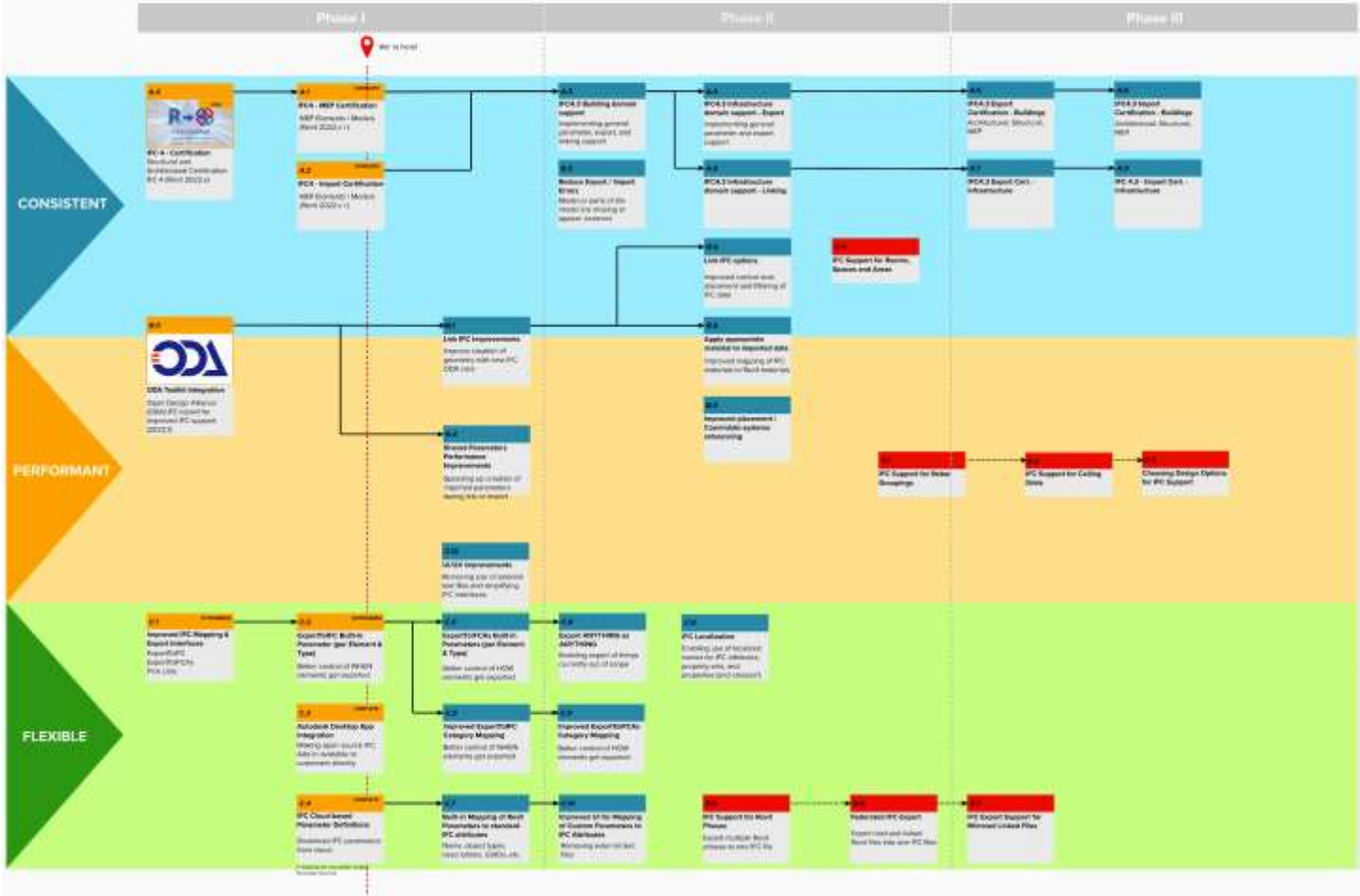
older format still supported in Revit, only recommended in the recipient‘s software doesn‘t support IFC 2x3

Revit IFC Roadmap

Recent and Planned

REVIT + IFC VISION MAP

An outline for the development of IFC functionality in the Revit platform, including improvements to existing features, introduction of new functionality, and enhancements to user experience and interface aspects



DRAFT

Ultimate IFC Experience

Objective

Position Autodesk Revit as First-in-Class Desktop BIM Application for IFC Interoperability

CONSISTENT

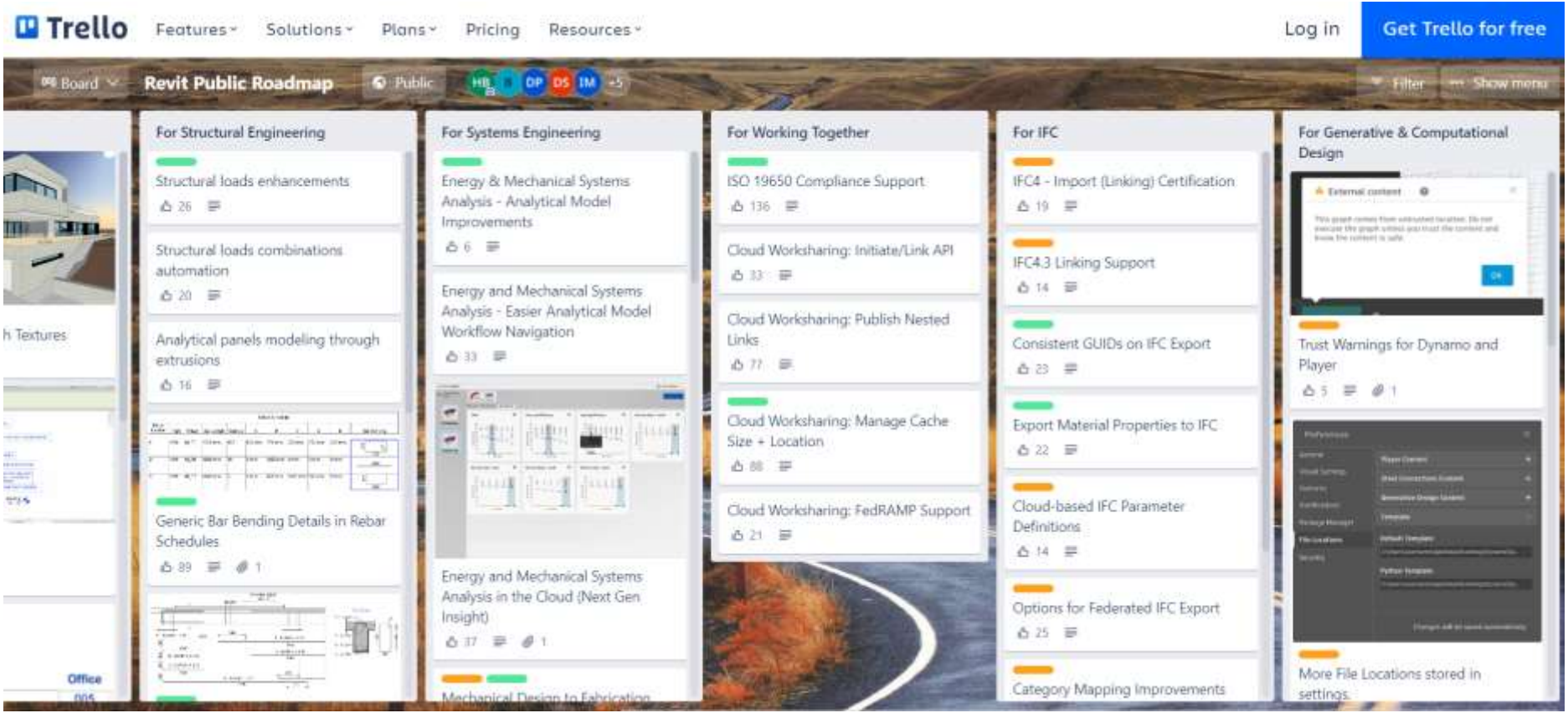
Boomerhites & Properties will be consistently authored and consumed when exchanging data between partners utilizing IFC formats in the design of Buildings and Infrastructures

PERFORMANT

The time experienced for reading and authoring data exchanged via IFC is reasonable.

FLEXIBLE

Work can be completed in a meaningful manner which supports unique project requirements and goals through flexibility in how data is defined and understood when exchanged via IFC


Trello
Features
Solutions
Plans
Pricing
Resources
Log in
Get Trello for free
Board
Revit Public Roadmap
Public
Filter
Show menu
For Structural Engineering
Structural loads enhancements
Structural loads combinations automation
Analytical panels modeling through extrusions
Generic Bar Bending Details in Rebar Schedules
For Systems Engineering
Energy & Mechanical Systems Analysis - Analytical Model Improvements
Energy and Mechanical Systems Analysis - Easier Analytical Model Workflow Navigation
Energy and Mechanical Systems Analysis in the Cloud (Next Gen Insight)
For Working Together
ISO 19650 Compliance Support
Cloud Worksharing: Initiate/Link API
Cloud Worksharing: Publish Nested Links
Cloud Worksharing: Manage Cache Size + Location
Cloud Worksharing: FedRAMP Support
For IFC
IFC4 - Import (Linking) Certification
IFC4.3 Linking Support
Consistent GUIDs on IFC Export
Export Material Properties to IFC
Cloud-based IFC Parameter Definitions
Options for Federated IFC Export
Category Mapping Improvements
For Generative & Computational Design
Trust Warnings for Dynamo and Player
More File Locations stored in settings

Autodesk IFC investments

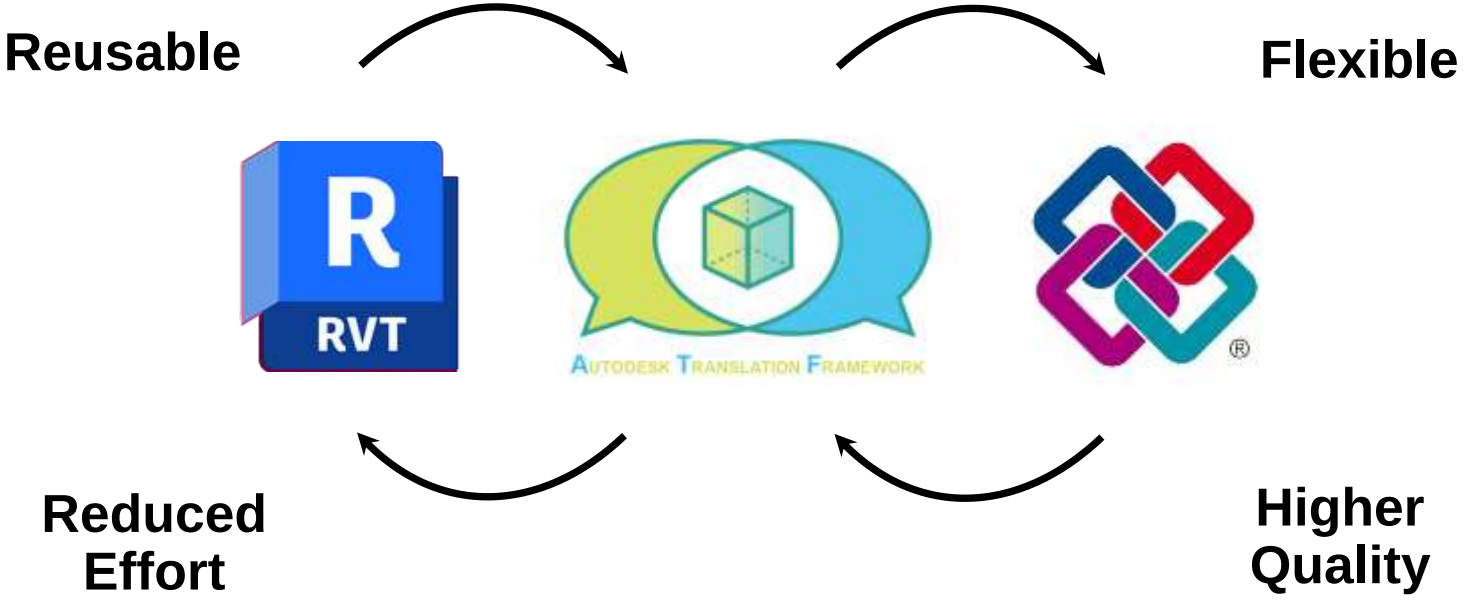
Autodesk joined the Open Design Alliance in 2020 and will adopt their IFC software development kit, beginning with integration into Revit.

Early adoption of ODA SDK → ODA IFC Cross Product Framework

Short Term **Longer Term**

IFC + ATF the next next generation

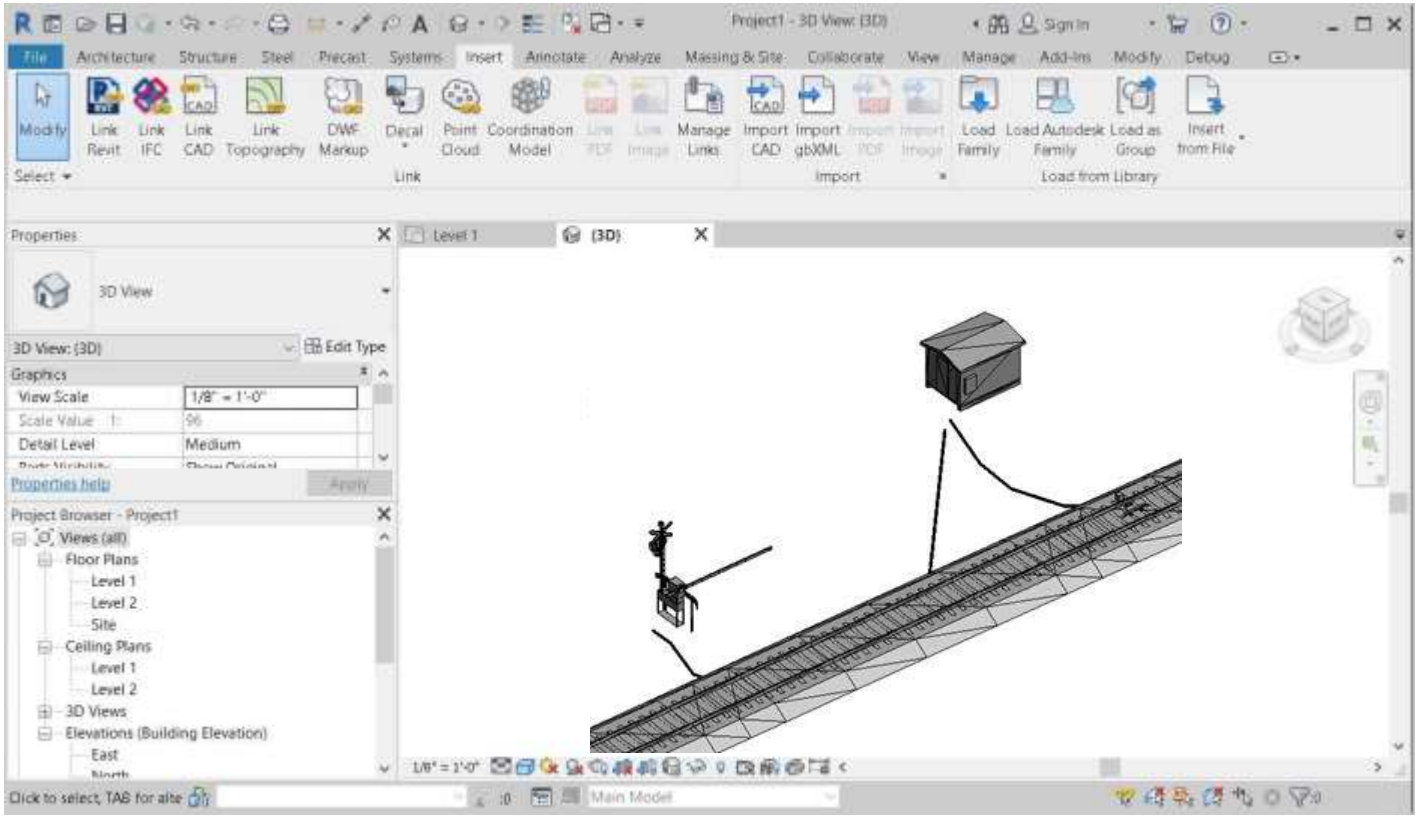
Forward plan for advanced support across solutions

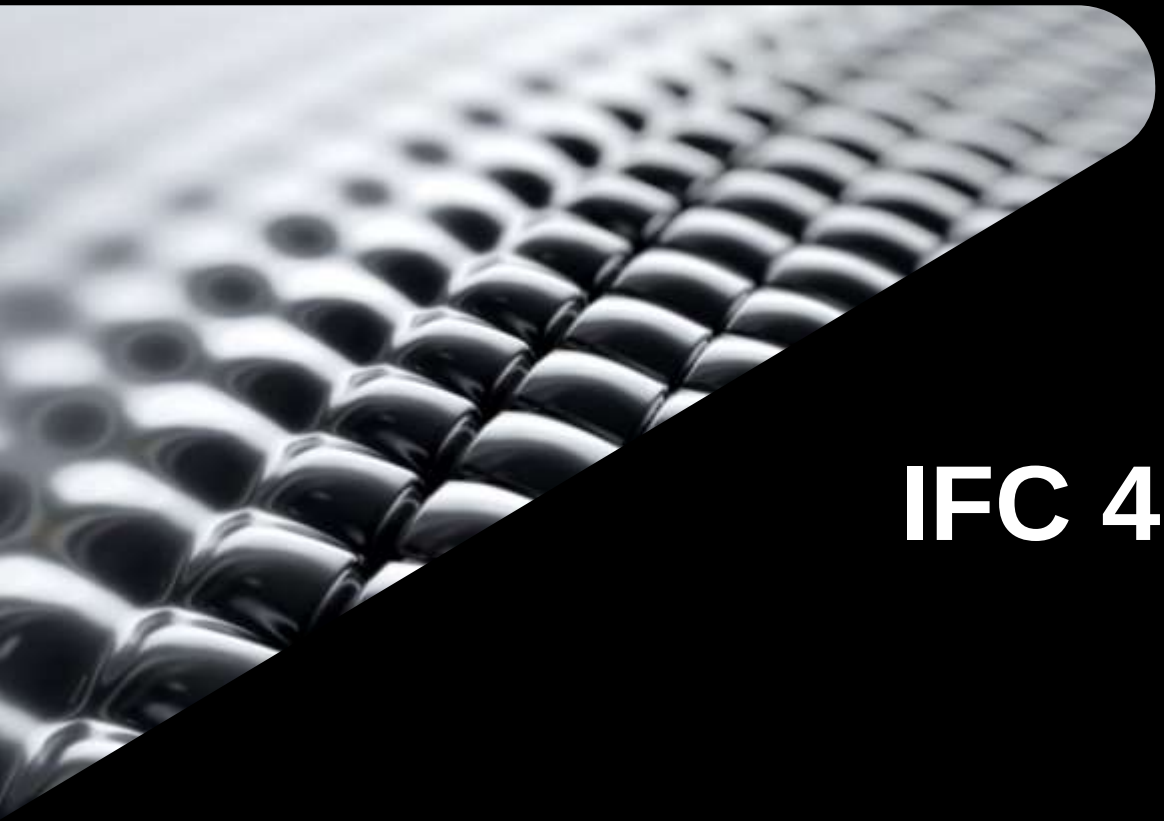


IFC Open Source

Revit ODA implementation

Beta example of IFC 4.3 import





IFC 4.3 for Civil 3D

Delivering IFC for infrastructure

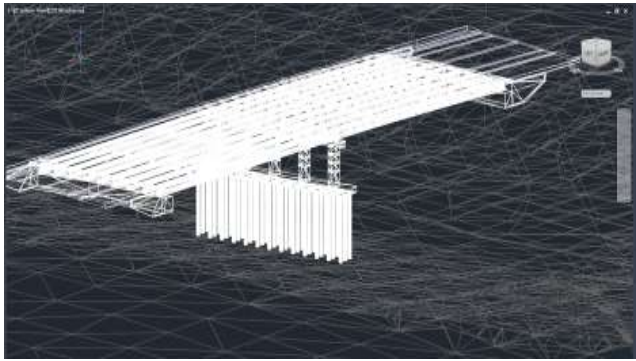
IFC 4.3 Plugin for Civil 3D

- New Plugin for IFC workflows in Civil 3D
- Supports Multiple IFC Formats
  - Import of IFC 2x, 4, 4x1, 4x2 and 4x3
  - Export of IFC 4 Reverence Views and IFC 4x3
- Supports Object to IFC Entity and Type Mapping
- Supports MetaDATA to IFC Property Mapping
- Supports Sectional Swept Solids and Fallback BREP Geometry

IFC 4.3 Plugin for Civil 3D Geometry

- Data is exported relative to a local datum

- Civil 3D COGO Points / Point Groups, Feature Lines, Surfaces, Alignments, Corridors, Bridges and Pressure and Gravity Pipe Networks are exported, along with AutoCAD solids, polylines and blocks



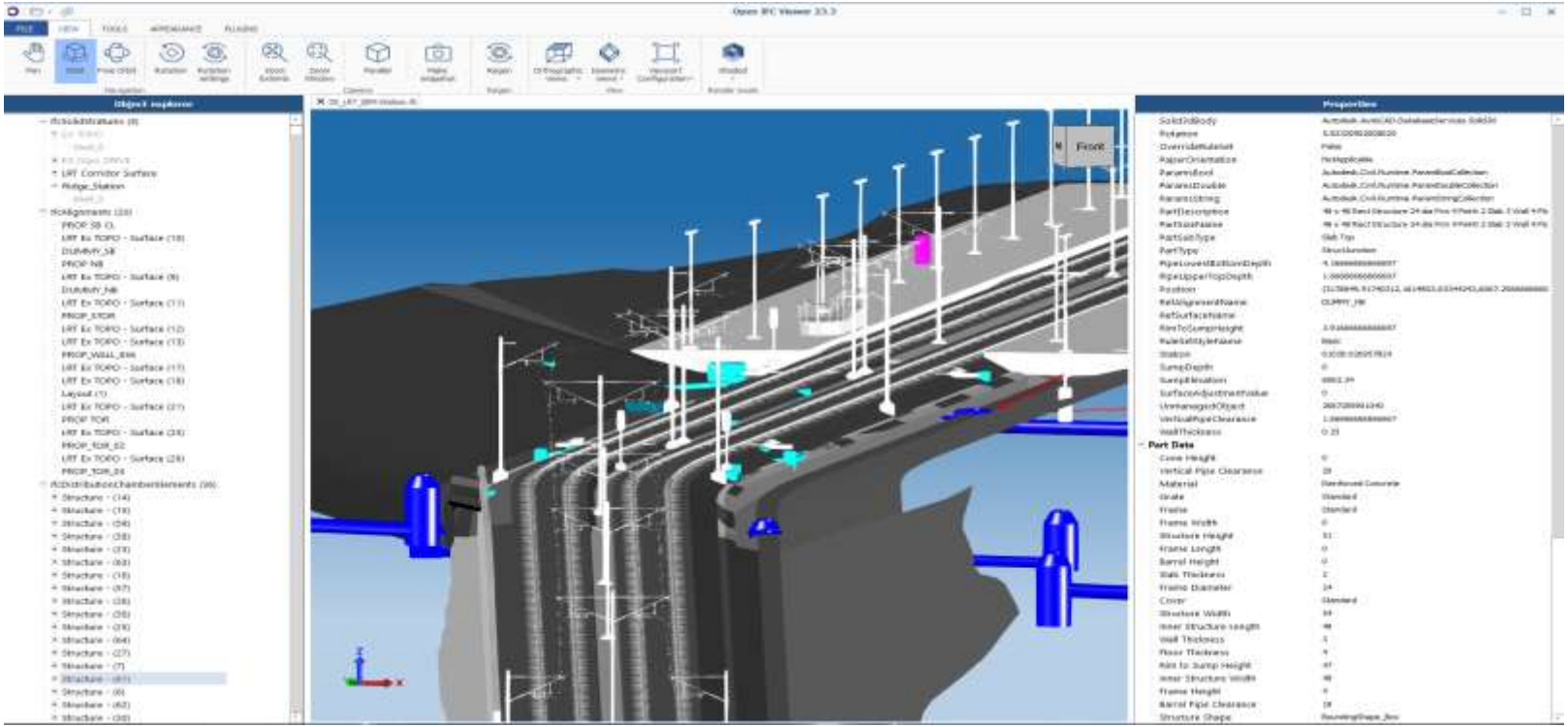
- This IFC Solution is focusing on 3D Objects
  For example, the following are out of scope:
  - 2D CAD entities (Lines, Arc's, Circles etc)
  - Text, Mtext, Tables, Labels etc
  - Paper Space, Cross Sections and Profile Views
  - Assembly Definitions

IFC 4.3 Design to Design workflows

- IFC does not support detailed Design to Design workflows
- Parametric or Calculated geometry is exported as solved 3D Objects
- Alignments/Profiles are broken down to solved Curves and Tangents
- Design “Parameters” or “Connections” are not handled by IFC
- A Corridor defined by assemblies is exported as a collection of “solved” cross sections, swept solids, lofted surfaces and feature lines
- The objects used to solve the corridor like assemblies, targeting etc are not part of IFC

IFC 4.3 Plugin for Civil 3D

Support includes Blocks, AutoCAD Solids, Civil 3D COGO Points / Point Groups, Feature Lines, Surfaces, Alignments, Corridors, Bridges and Pressure and Gravity Pipe Networks



IFC 4.3 Plugin for Civil 3D Meta Data

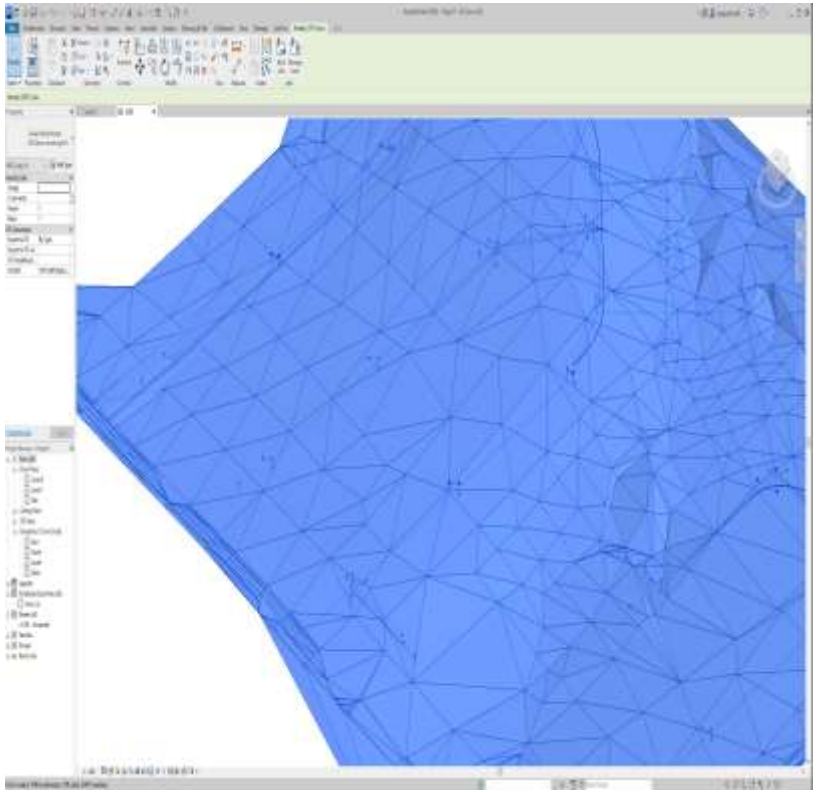
- Exported Objects are Metadata Rich Containing
  - Colors
  - Materials
  - Fixed IFC GUID for Objects Re-Exported
  - Property Set Data
  - UDP (User Defined Parameters)
  - Pipe / Structure / Fitting Part Data
  - Generic Object properties

- Imported Objects bring in all properties as UDP and Property Sets along with the objects IFC GUID

Exchange via IFC from Civil 3D to Revit

- *Revit Imports the following Objects as Direct Shapes*
  - *Surfaces*
  - Bridges
  - *Gravity and Pressure Pipes*
  - *Corridors*
  - *AutoCAD Solids*
  - *Blocks*

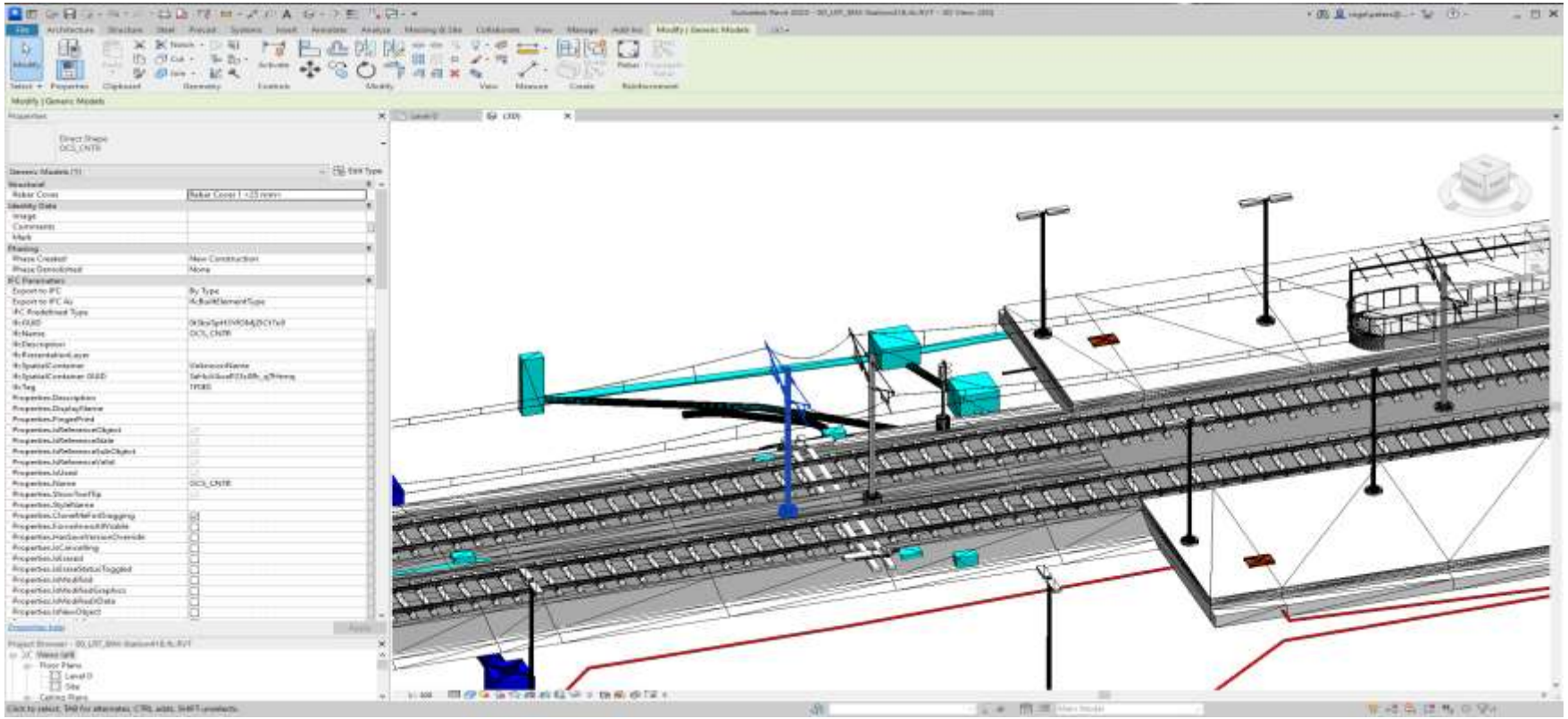
- All Objects include Metadata



Civil Rail into Revit via IFC for Stations

IFC 4.3

Direct transfer of infrastructure corridors, pipes, surfaces and manholes etc

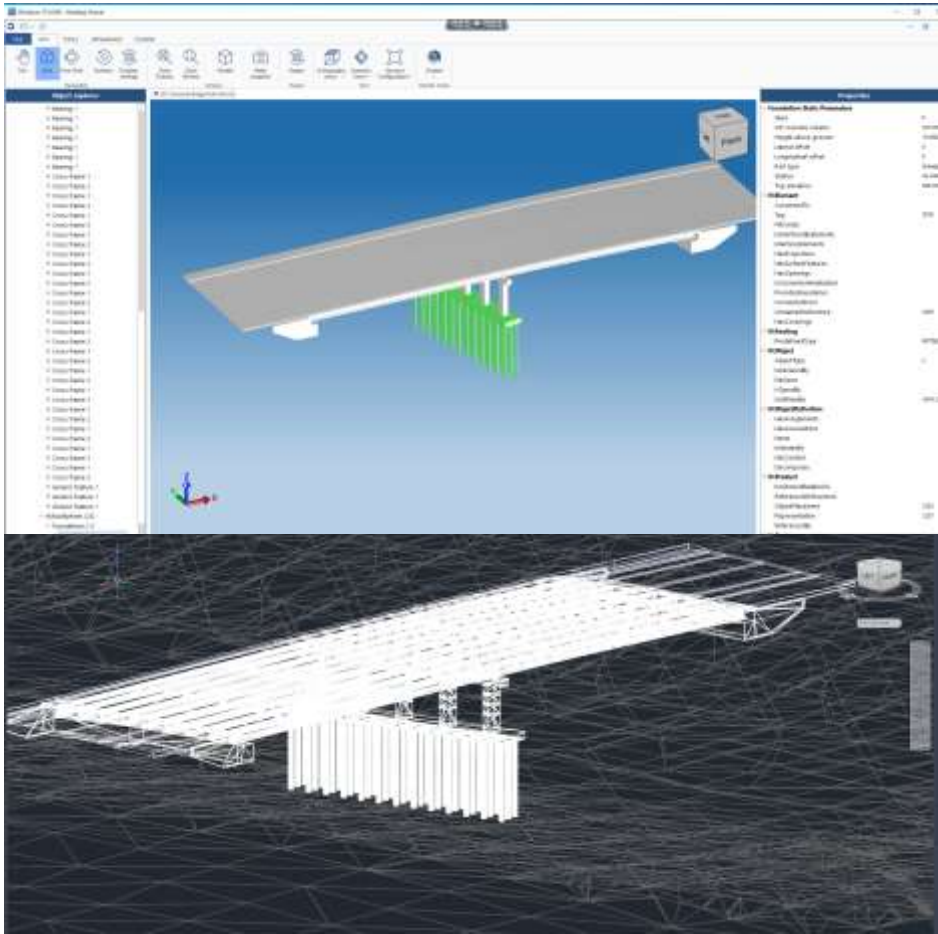


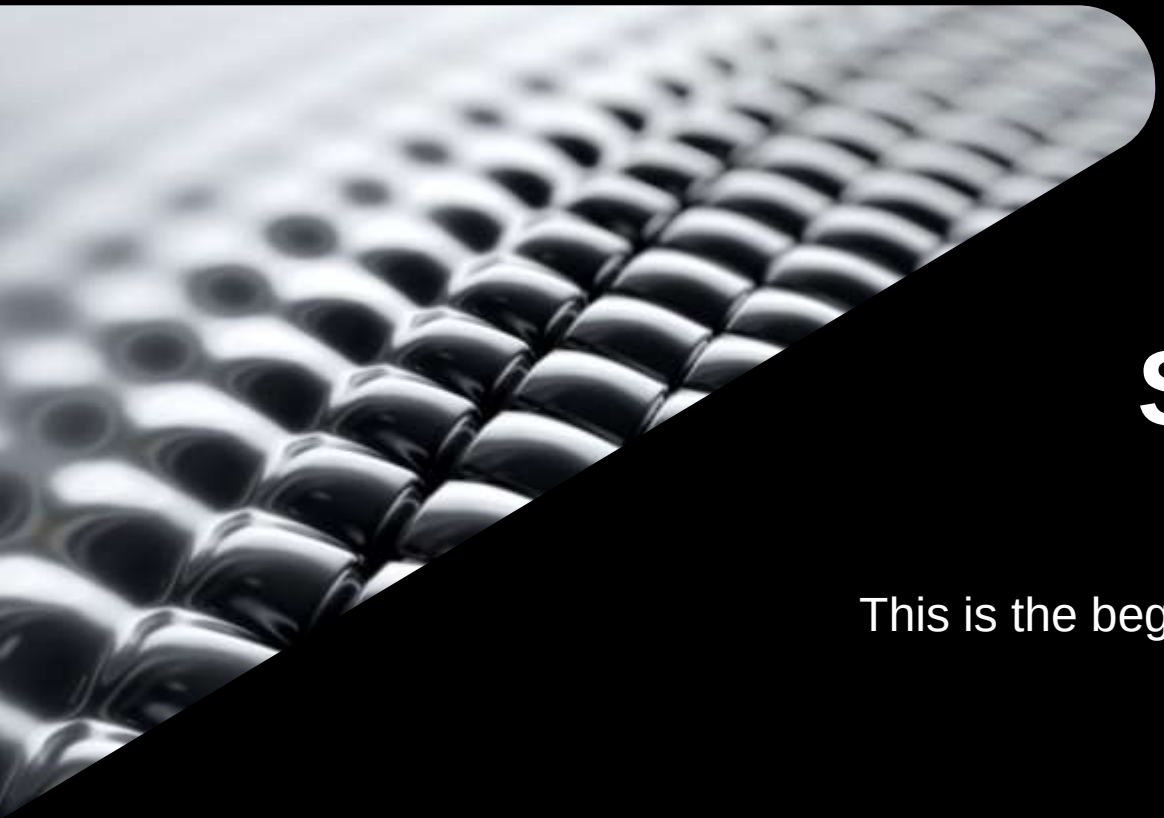
Importing IFC into Civil 3D

- *IFC Objects That Import as Civil 3D Entities*
  - *Alignments*
  - *Feature Lines*
  - *Surfaces*
  - *Sites*
  - *CoGo Points / Point Groups*
  - *PolyLines*

- All other objects import as AutoCAD Solids

- All Objects include Metadata





Summary and what’s next

This is the beginning of our continuing mission

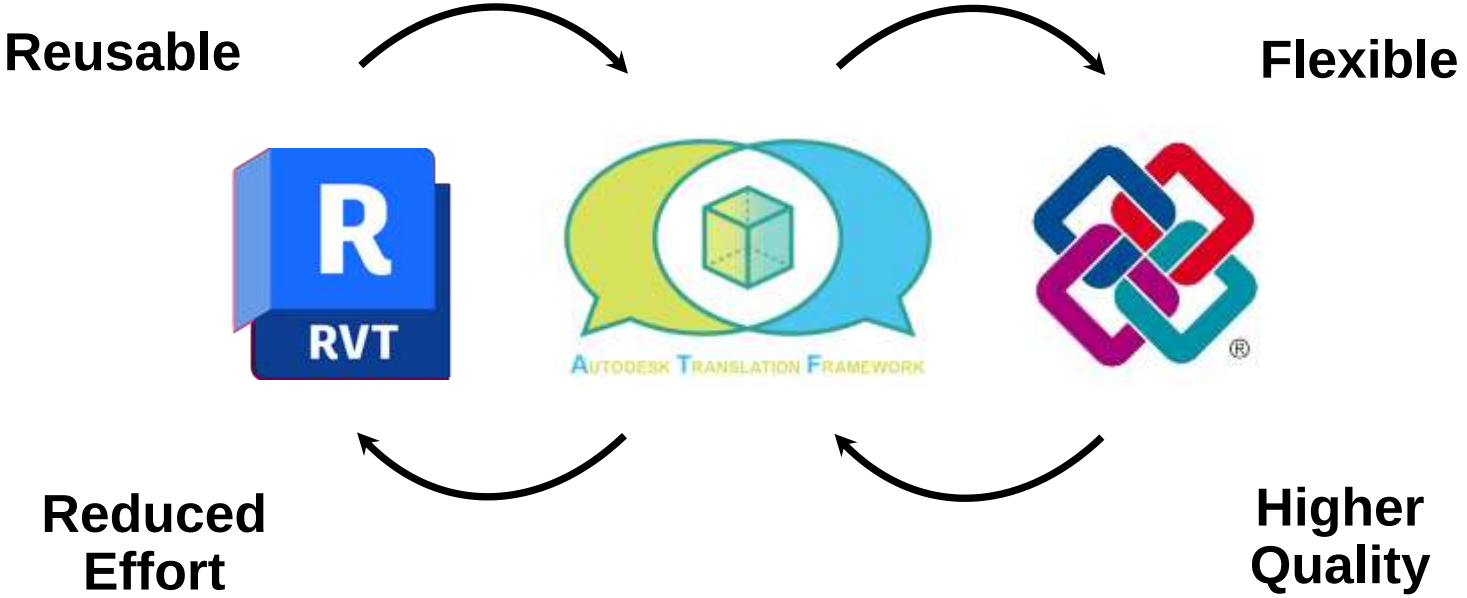
What can you benefit from now?

Boldly go in using IFC in projects and for handover

- IFC 4.3 has been released and will become an ISO standard update in 2023
- buildingSMART is continuing to extend IFC for infrastructure support with Tunnel and new Marine extensions in progress, as well as other investments e.g. BSDD, IDS and IFC 5
- Public and private sector owners are expected to specify IFC 4.3 in contracts soon
- Autodesk solutions will offer IFC support to meet new requirements
  - Revit has enhanced support for IFC including 4.3 import, in current release
  - Civil 3D IFC 4.3 plugin is available via *manage.autodesk.com*
  - All pre-existing support for IFC is still available in products
- Autodesk are awaiting for buildingSMART to make IFC 4.3 certification available

ATF and IFC

Continuing mission to extend consistent IFC support across our products



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