AUTODESK® UNIVERSITY

AUTODESK @ TUM

Aktuelle Entwicklungen in Forschung und Lehre

Sebastian Esser

Wissenschaftlicher Mitarbeiter

Lehrstuhl für Computergestützte Modellierung und Simulation | Technische Universität München

Sebastian Esser, M.Sc.

Wissenschaftlicher Mitarbeiter

2013-2018: Studium Bachelor und Master Bauingenieurwesen an der Technischen Universität München

Seit 2018: Wissenschaftlicher Mitarbeiter/Doktorand, Lehrstuhl für computergestützte Modellierung und Simulation, Technische Universität München

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LOC Collaboration Model

5 chairs

Expertise of 80 TUM researchers

> 60.000 industry specialists

Studienprogramm Bau- und Umweltingenieurwesen

Bachelor Civil / Environmental Engineering

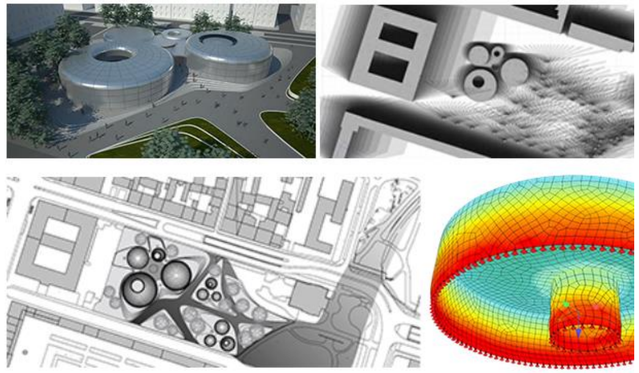
Course	Compulsory/Elective	Semester	WS/SS	SWS	Credits
Bau- und Umweltinformatik 1	C	1	WS	4	5
Bau- und Umweltinformatik 2	C	2	SS	4	5
Bau- und Umweltinformatik Ergänzungsmodul	E	5	WS	4	5
Softwareschulung BIM	E	-	WS/SS	-	0

Master Civil / Environmental Engineering / Computational Mechanics

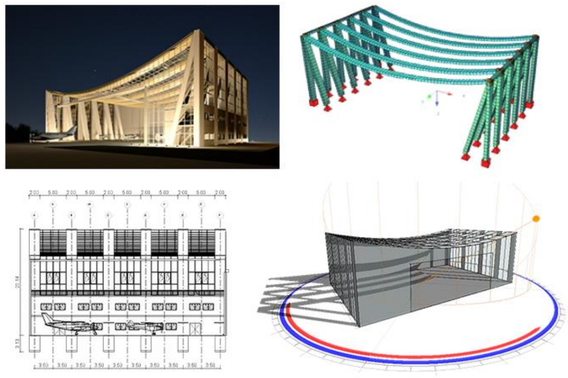
Informationen zum Vertiefungszweig Building Information Modeling

Course	C/E	WS/SS	SWS	Credits
Computation in Engineering 1	C	WS	3	6
Computation in Engineering 2	C	SS	3	6
Artificial Intelligence in Engineering	E	SS	2	3
Engineering Databases	E	WS	2	3
Building Information Modeling	E	WS	3	6
Advanced Topics in Building Information Modeling	E	SS	2	3
Professional Software Development	E	SS	2	4 | COME: 3
Softwarelab	E	WS + SS	4	6
Think.Make.Start.	E	-	3	6

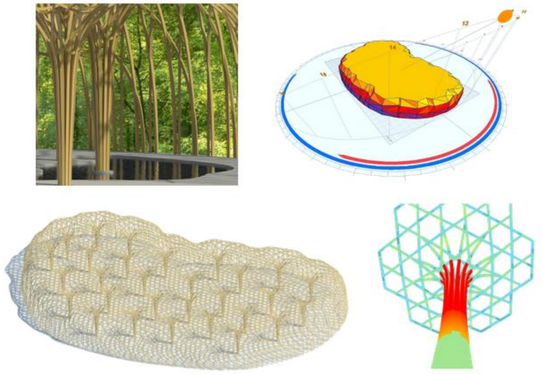
Interdisziplinärer BIM-Kurs (seit 2011)



TUM Tropical Island WS 11/12

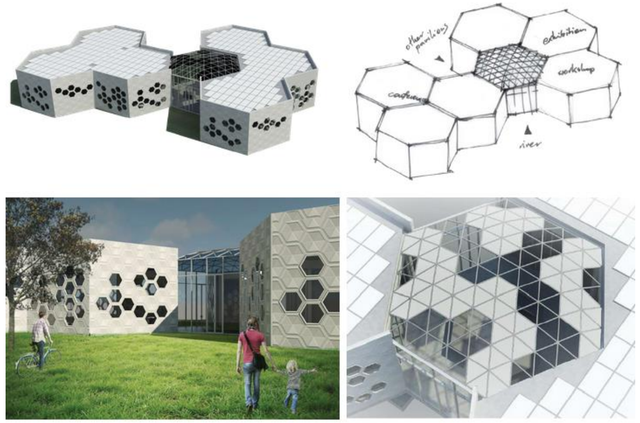


TUM Hangar WS 12/13



TUM Tropical Island WS 13/14

TUM Bierzelt WS 14/15



TUM Expo WS 15/16

TUM Craft Race WS 17/18

TUM Makerspace WS 18/19

TUM Alpine Retreat WS 19/20

BIM360 in der Lehre

AUTODESK® BIM 360™ Lösungen Produkte Ressourcen Preise Kontakt und Support +49 800 100 6825 Produktvorführung ansehen

BAUMANAGEMENT-SOFTWARE

Vernetzen, organisieren und optimieren Sie Ihre Projekte

BIM 360 ist eine vereinheitlichte Plattform, die Ihre Projektteams und Daten in Echtzeit vom Entwurf bis zur Bauausführung vernetzt und so fundierte Entscheidungen unterstützt und zu besser vorhersehbaren und rentableren Ergebnissen führt.

FORGE

Lehrveranstaltungen / Building Information Modeling

campus.tum.de/tumonline/ee/ui/ca2/app/desktop/#/slc.tm.cp/student/courses/950492958?$ctx=design=ca;lang=de

Campus-Management-System TUMonline
Technische Universität München

Wartung: 23.10.2020, 12:00 - 12:40 Anmelden DE EN

Lehrveranstaltungen / Building Information Modeling

Zurück

Überblick

Beschreibung

Termine und Gruppen

Stellung im Studienplan

Gleiche Lehrveranstaltungen

Anmeldedetails einsehen

LV-Anmeldung möglich

Überblick

Titel	Building Information Modeling
Nummer	0000001463
Beteiligte Personen	**Vortragende*r (Mitwirkende/r)** Borrmann, Andre Petzold, Frank Vilgertshofer, Simon Fellner, Jakob Forth, Kasimir ... alle anzeigen
Art	Vorlesung (VO)
Semesterwochenstunden	2
ECTS-Credits	-
Unterrichtssprache/n	**Englisch (primär)**, Deutsch
Angeboten im Semester	Wintersemester 2020/21
Organisation	Lehrstuhl für Computergestützte Modellierung und Simulation (Prof. Borrmann)

BIM360 in der Lehre

BIM360-Administration für den Einsatz an Hochschulen und Universitäten

Automatisierte Administration:

Erstellung von Projekten und Ordnern	User-Management	Rollen und Rechte	Upload von Beispielen

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	project_name	project_type	root_folder	level_1	level_2	level_3	permission	role_permission	user_email	industry_role	company	company_trade	local_folder
2	Sample Project	Office	Plans				V		user1@company.com	Architect, Engineer	Company1	Communications	
3							V		user2@company.com	Foreman, Executive	Company2	Architecture	
4				Folder1			V+D		user2@company.com				
5							V	Engineer					
6					Folder1.1		V		user3@company.com	Estimator	Company3	Electrical	Data1
7						Folder1.1.1							
8						Folder1.1.2	V+D+U	Architect	user1@company.com				
9							V+D+U	Foreman					
10						Folder1.1.3	Full		user2@company.com				
11					Folder1.2		V+D+U+E		user4@company.com	BIM Manager	Company2		
12							U		user3@company.com				
13						Folder1.2.1	V+D+U		user3@company.com				
14				Folder2			V+D		user2@company.com				
15					Folder2.1								
16						Folder2.1.1							
17						Folder2.1.2	V+D+U		user1@company.com				
18							V+D+U		user2@company.com				
19						Folder2.1.3	Full		user2@company.com				
20					Folder2.2		V+D+U+E		user4@company.com				
21							U	Engineer					
22						Folder2.2.1	V+D+U		user3@company.com				
23			Project Files				V		user1@company.com				
24							V		user2@company.com				
25				Folder11			V+D		user2@company.com				
26					Folder11.1		V		user3@company.com				
27						Folder11.1.1							
28						Folder11.1.2	V+D+U		user1@company.com				
29							V+D+U		user2@company.com				
30						Folder11.1.3	Full		user2@company.com				
31					Folder11.2		V+D+U+E		user4@company.com				
32							U		user3@company.com				
33						Folder11.2.1	V+D+U		user3@company.com				
34				Folder22			V+D		user2@company.com				
35					Folder22.1								
36						Folder22.1.1							
37						Folder22.1.2	V+D+U		user1@company.com				
38							V+D+U		user2@company.com				
39						Folder22.1.3	Full		user2@company.com				
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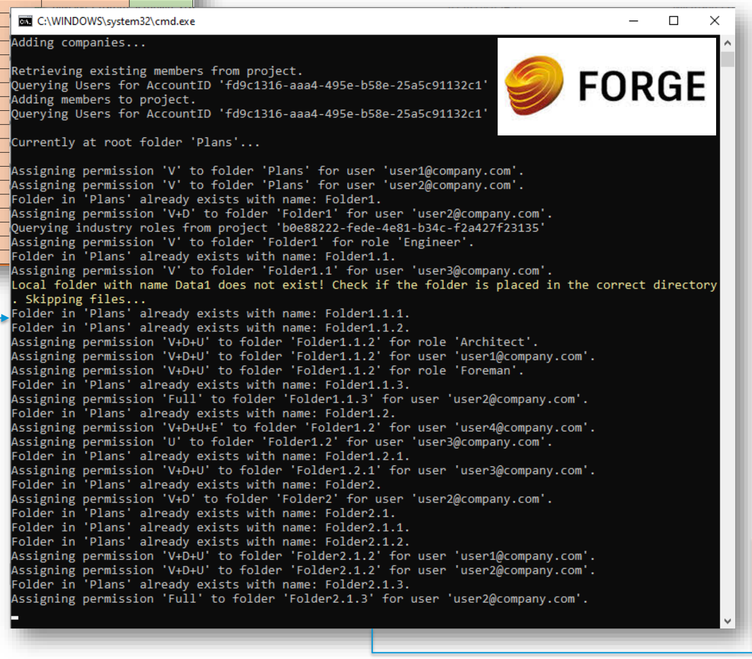
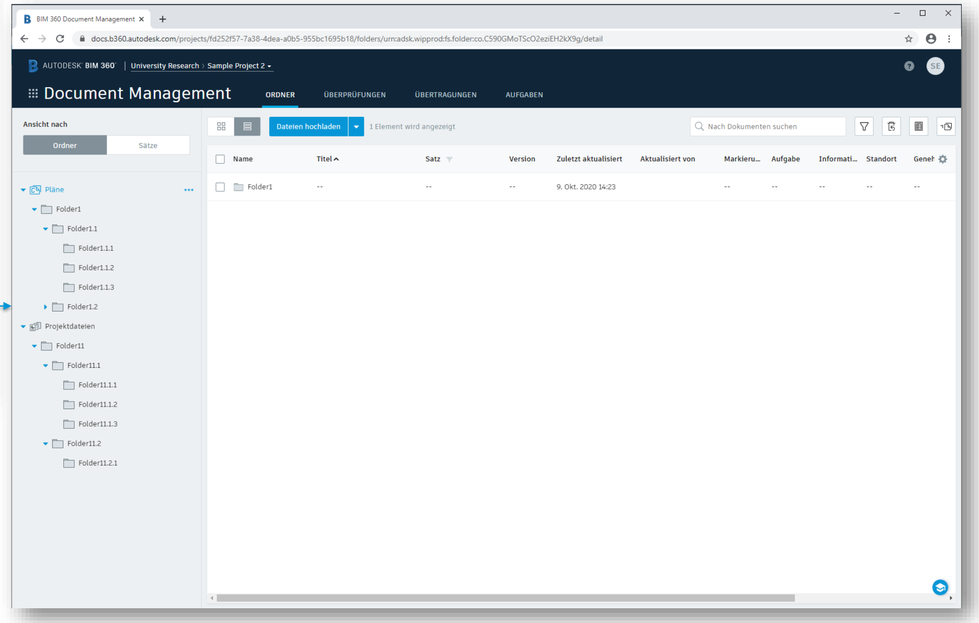
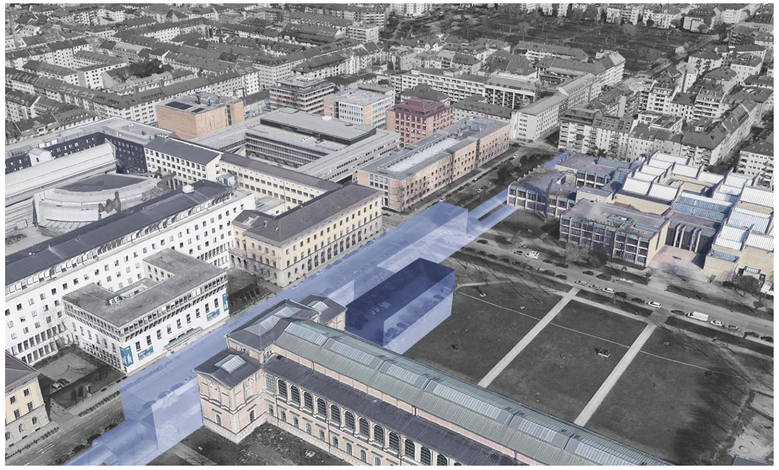
41							U		user3@company.com				
42						Folder22.2.1	V+D+U		user3@company.com				

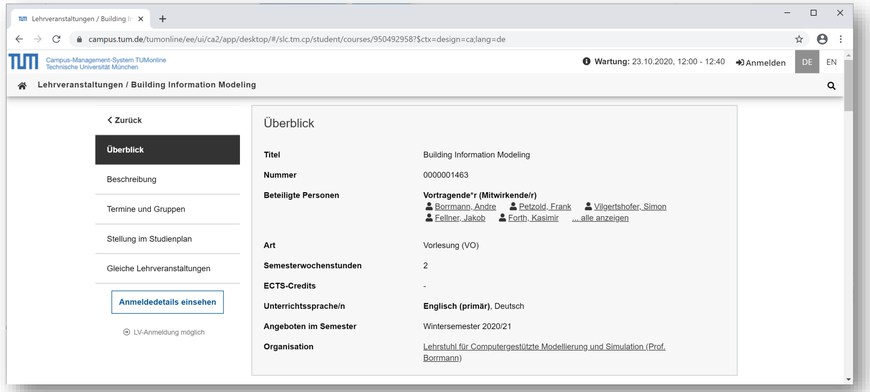


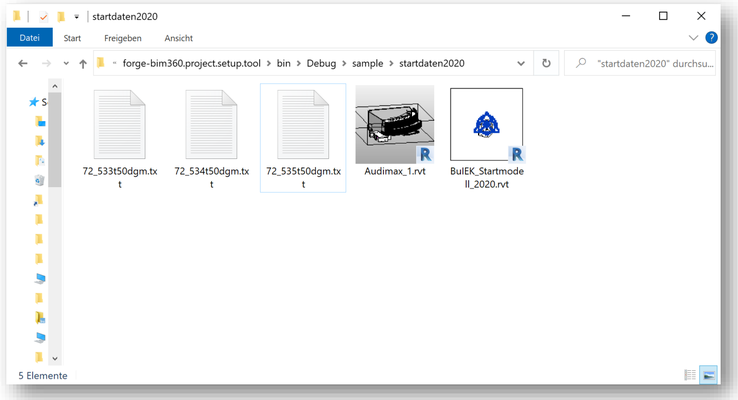


BIM360 Setup-Tool



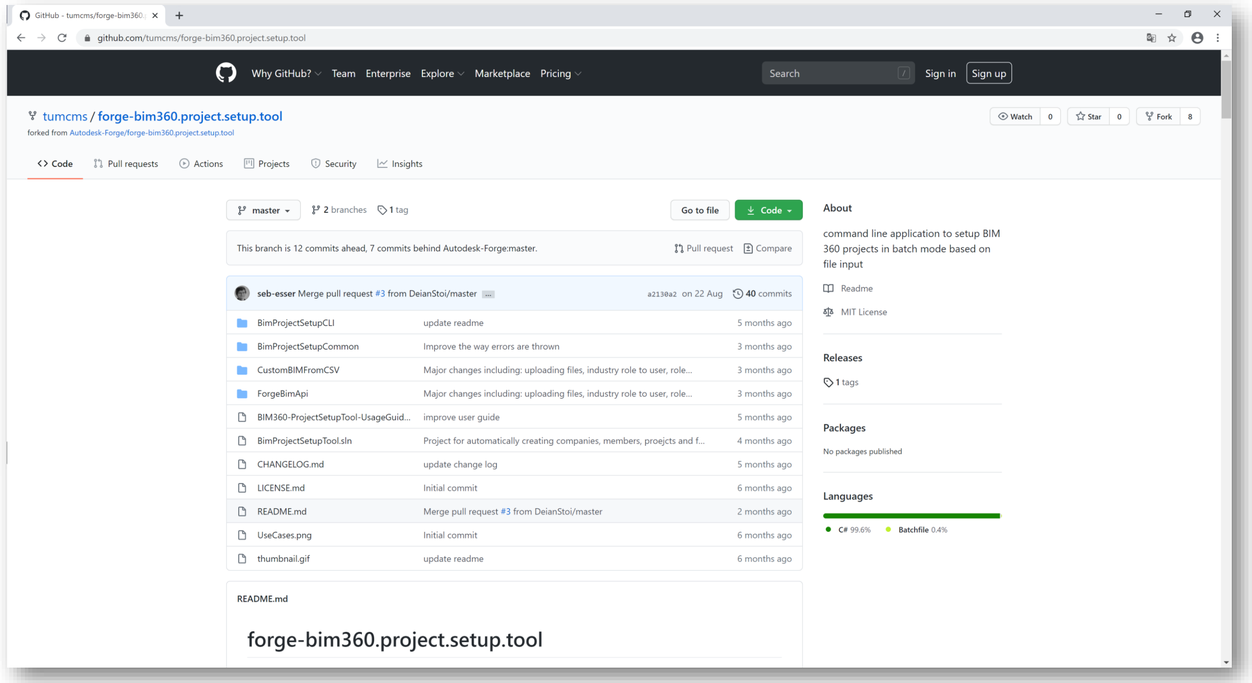
BIM-Kurs SoSe2020: U9-Haltestelle TUM

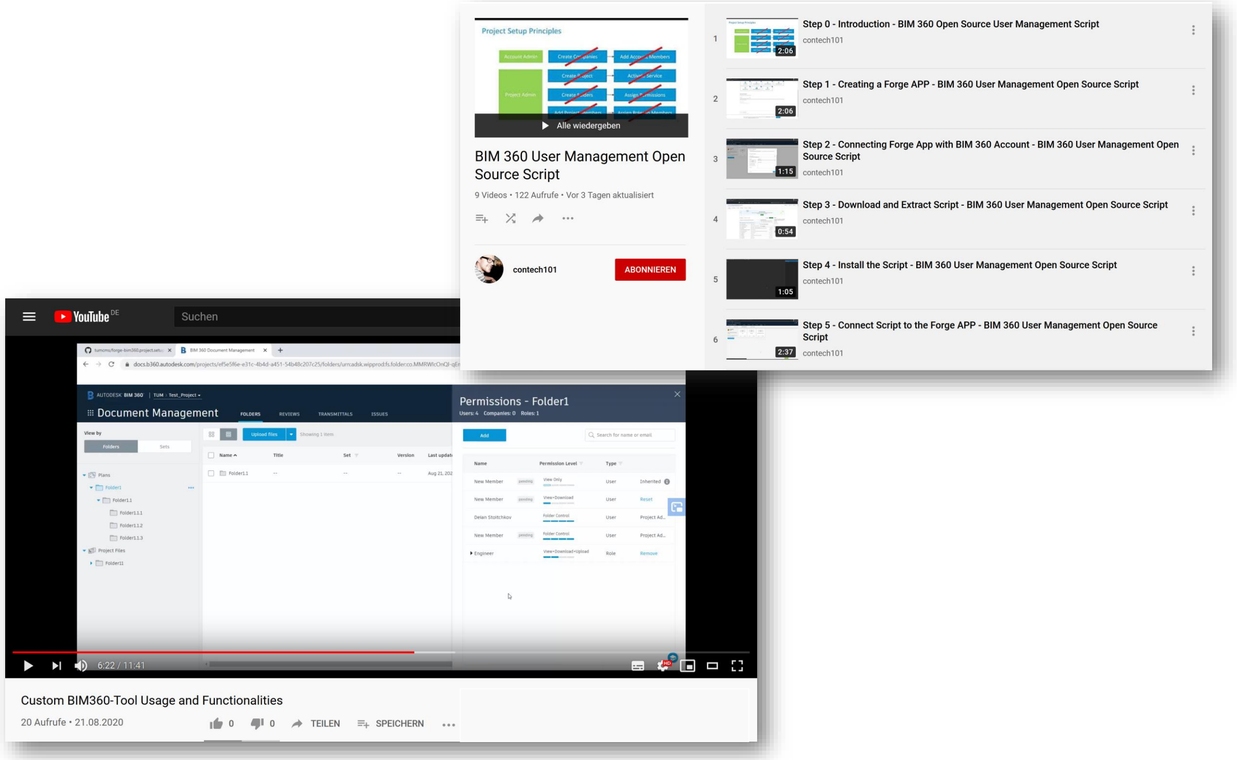




	A	B	C	D	E	F	G	H	I	J	K	L	M
1	project_name	project_type	root_folder	level_1	level_2	level_3	permission	role_permission	user_email	industry_role	company	company_trade	local_folder
2	BIM2021_Gruppe01	Office	Plans				V		s.esser@tum.de	Architect, Engineer	Technical University of Munich	Communications	
3				Folder1									
4			Models				V		student1@tum.de	Student	Technical University of Munich	Modeling	
5							V		student2@tum.de	Student	Technical University of Munich	Modeling	
6							V		student3@tum.de	Student	Technical University of Munich	Modeling	
7				Startdaten									startdaten2020
8													
9	BIM2021_Gruppe02	Office	Plans				V		s.esser@tum.de	Architect, Engineer	Technical University of Munich	Communications	
10				Folder1									
11			Models				V		student4@tum.de	Student	Technical University of Munich	Modeling	
12							V		student5@tum.de	Student	Technical University of Munich	Modeling	
13							V		student6@tum.de	Student	Technical University of Munich	Modeling	
14				Startdaten									startdaten2020
15													
16													

Weitere Informationen





Github:
https://github.com/tumcms/forge-bim360.project.setup.tool

Full Tutorial:
https://www.youtube.com/watch?v=e-XrIaqquA0&feature=youtu.be

Step by Step:
https://www.youtube.com/playlist?list=PL_ph56WaRJ7IsN7nXa6K5NUO-nNJegiYd

Development Team

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Implementation lead

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Autodesk Education Experiences (AEX)

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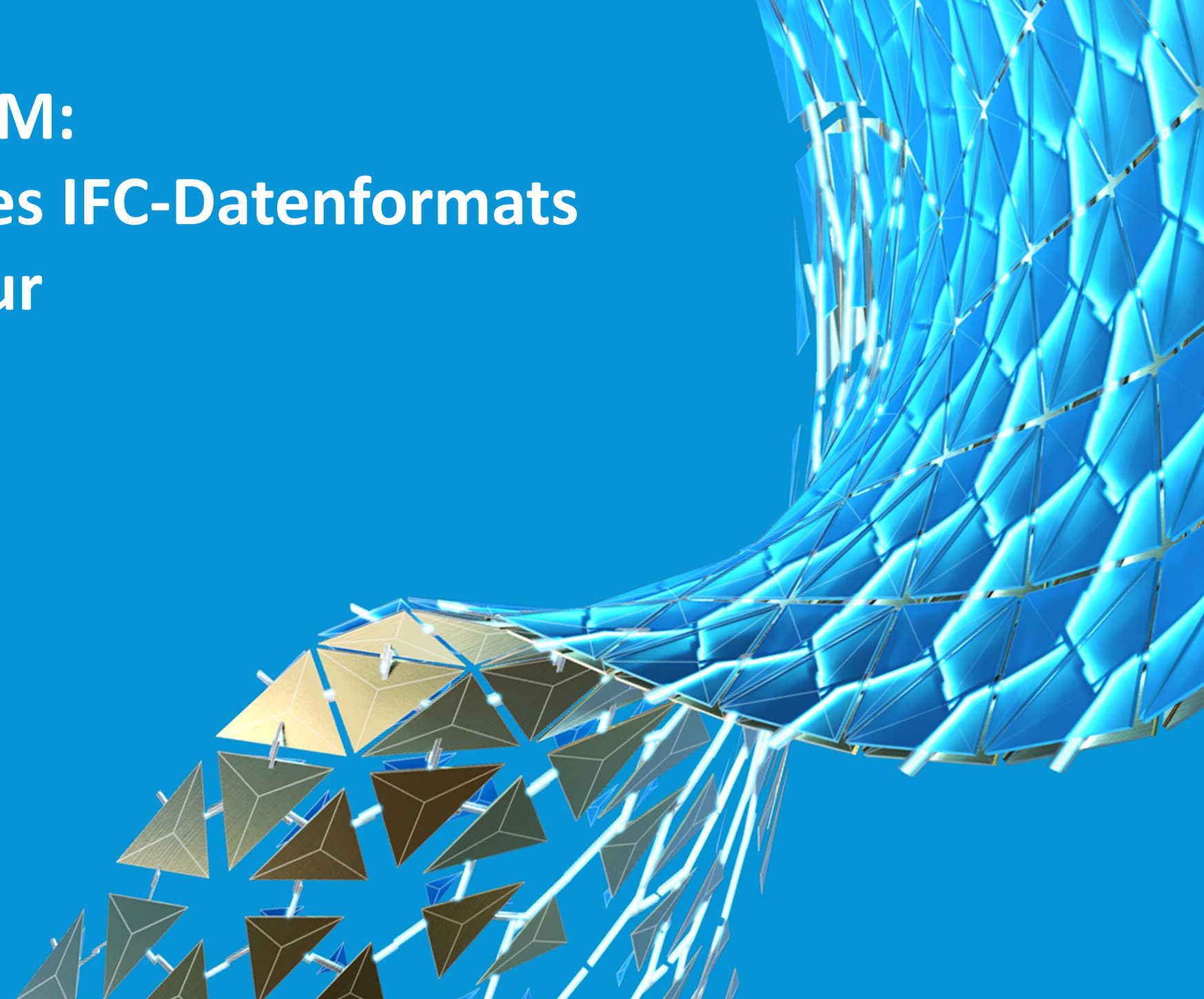
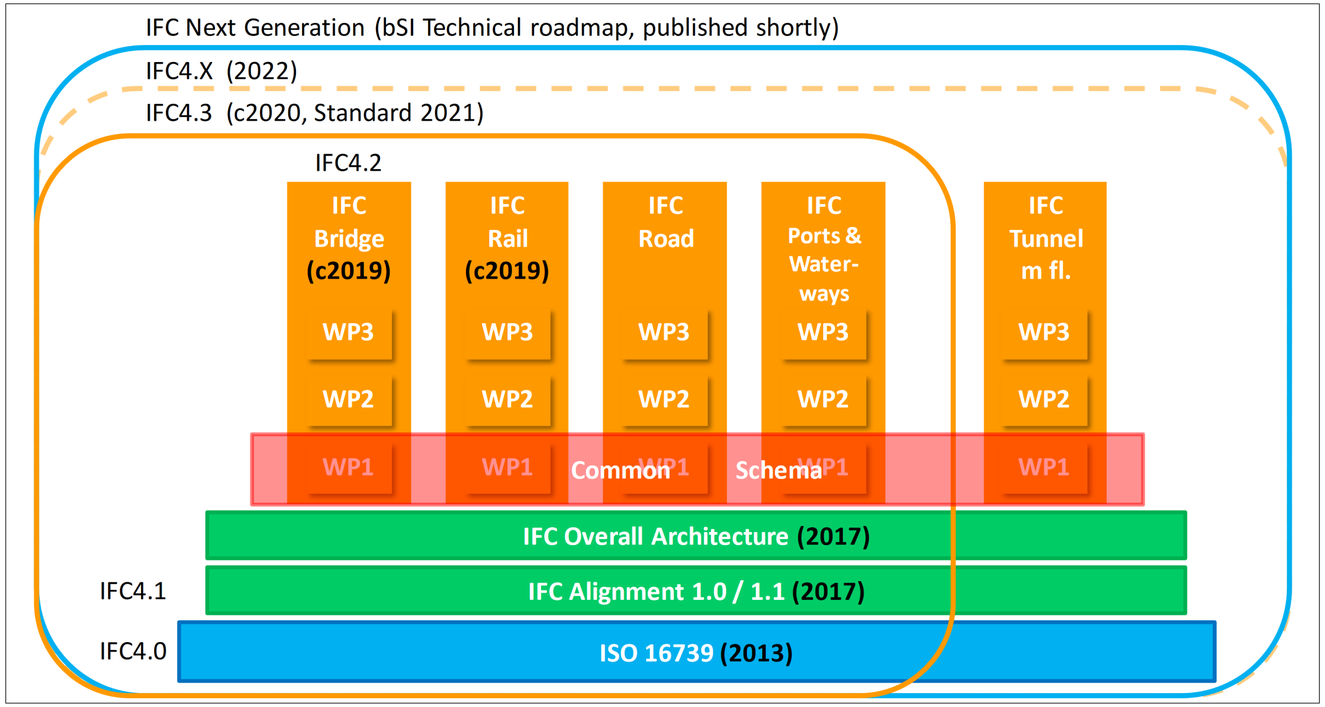
Autodesk + TUM: Erweiterung des IFC-Datenformats für Infrastruktur

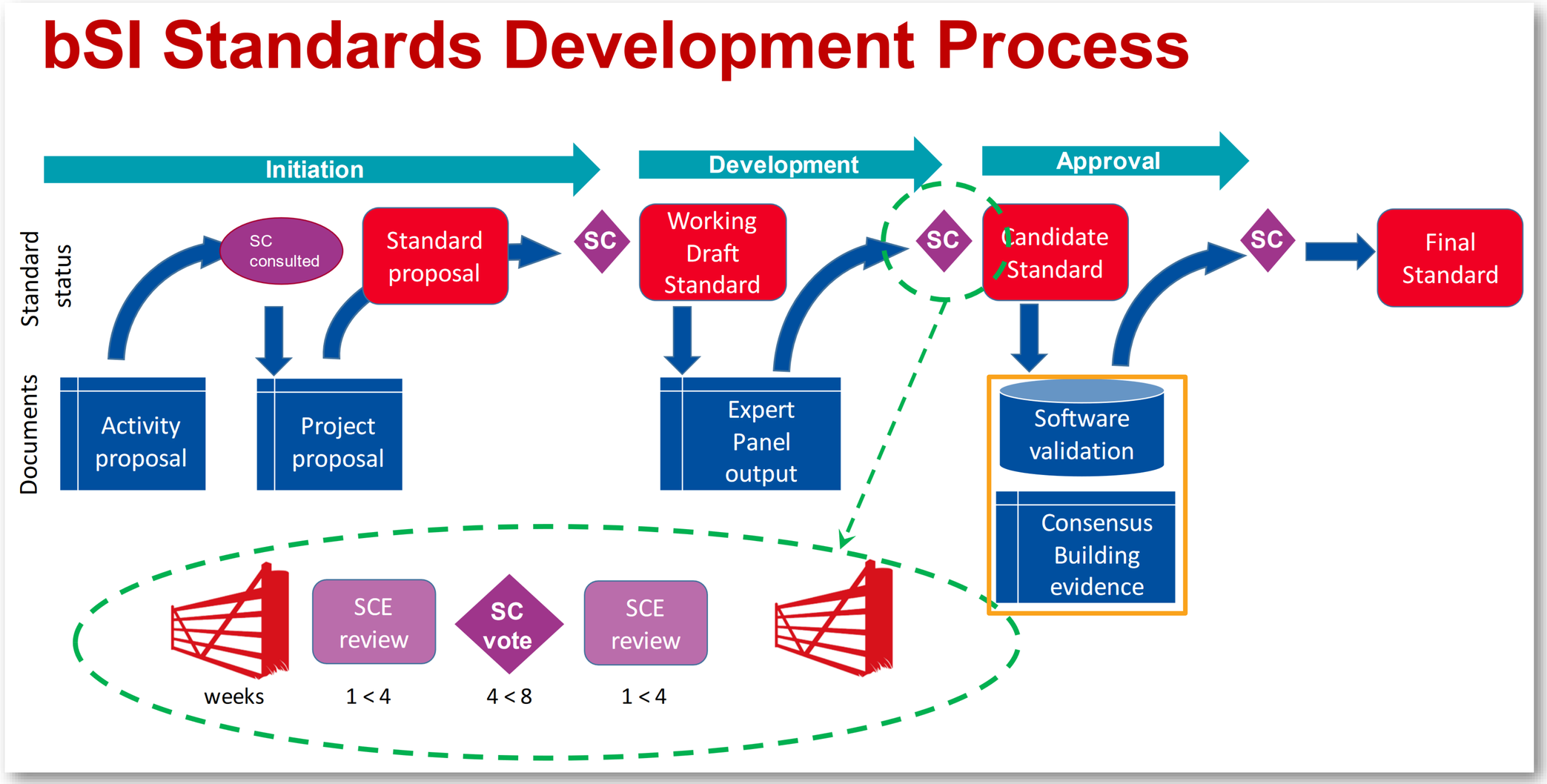


Industry Foundation Classes

- **Herstellerneutrales Datenmodell zum Austausch von BIM-Modellen**
- **Bis Version IFC4: Fokus auf Hochbau**
- **Seit 2010: Initiativen zur Erweiterung von IFC für Infrastruktur**
- **Seit 2018: Gemeinsame Beteiligung TUM/LOC – Autodesk an IfcRoad und InfraDeployment Projekten**

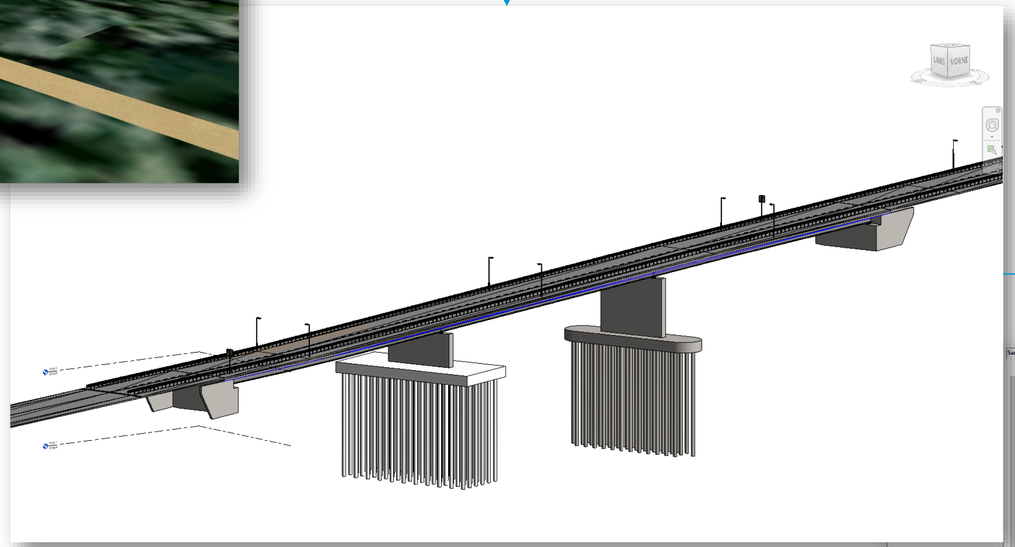


buildingSMART InfraDeployment Projekt: PoC IFC4x3

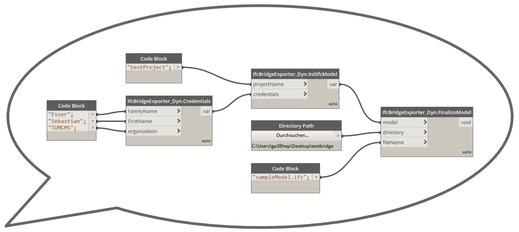


https://www.buildingsmart.org/about/bsi-process/

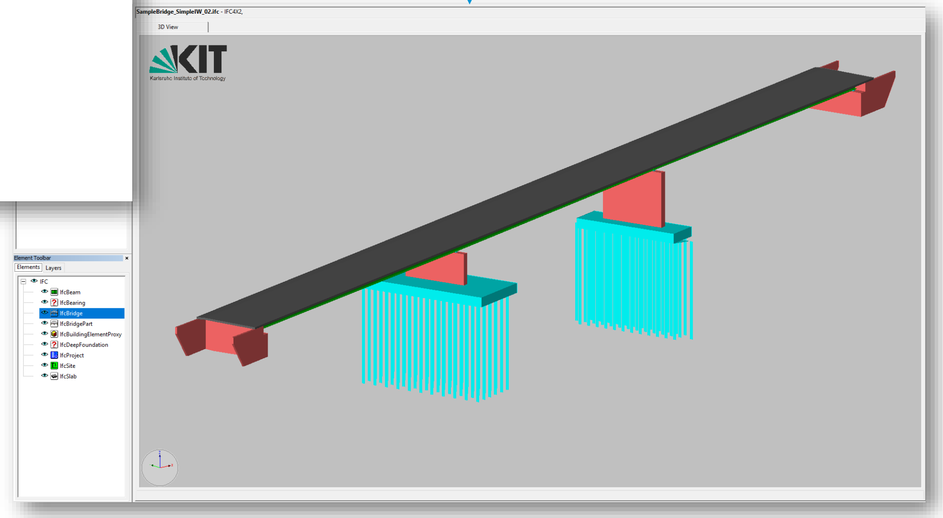
PoC IFC4x2 für InfraWorks/Revit



OpenSource:
https://github.com/tumcms/IfcBridgeToolKit

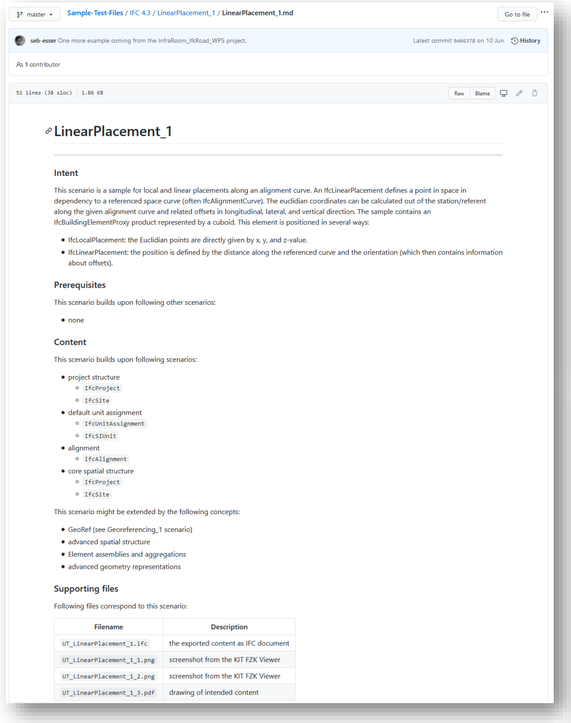


IfcBridgeToolKit + Dynamo

bSI: InfraDeployment & IfcRail Phase 2

- **Referenz-Implementierungen**



master · Sample-Test-Files / IFC 4.3 / LinearPlacement_1 / LinearPlacement_1.md · Go to file

seb-esser One more example coming from the InfraRoom_IfcRoad_WPS project. · Latest commit 9046378 on 10 Jun · History

1 contributor

51 lines (38 sloc) · 1.86 KB · Raw · Blame

LinearPlacement_1

Intent

This scenario is a sample for local and linear placements along an alignment curve. An IfcLinearPlacement defines a point in space in dependency to a referenced space curve (often IfcAlignmentCurve). The euclidian coordinates can be calculated out of the station/referent along the given alignment curve and related offsets in longitudinal, lateral, and vertical direction. The sample contains an IfcBuildingElementProxy product represented by a cuboid. This element is positioned in several ways:

- IfcLocalPlacement: the Euclidian points are directly given by x, y, and z-value.
- IfcLinearPlacement: the position is defined by the distance along the referenced curve and the orientation (which then contains information about offsets).

Prerequisites

This scenario builds upon following other scenarios:

- none

Content

This scenario builds upon following scenarios:

- project structure
  - `IfcProject`
  - `IfcSite`
- default unit assignment
  - `IfcUnitAssignment`
  - `IfcSIUnit`
- alignment
  - `IfcAlignment`
- core spatial structure
  - `IfcProject`
  - `IfcSite`

This scenario might be extended by the following concepts:

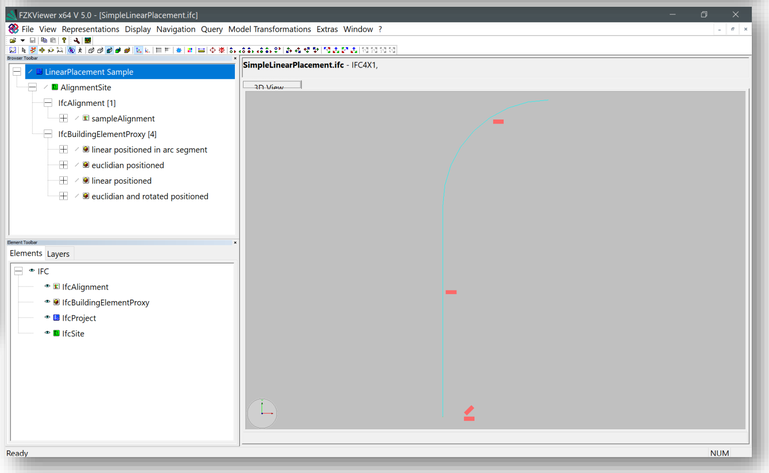
- GeoRef (see Georeferencing_1 scenario)
- advanced spatial structure
- Element assemblies and aggregations
- advanced geometry representations

Supporting files

Following files correspond to this scenario:

Filename	Description
`UT_LinearPlacement_1.ifc`	the exported content as IFC document
`UT_LinearPlacement_1_1.png`	screenshot from the KIT FZK Viewer
`UT_LinearPlacement_1_2.png`	screenshot from the KIT FZK Viewer
`UT_LinearPlacement_1_3.pdf`	drawing of intended content

```
/* -- Base setup: project, credits, units, ... */
#1=IFCPROJECT('2dGnaVksj48hS2oyo_XxlK',#2,'LinearPlacement Sample',$,$,$,$,(#15),#7);
#2=IFCOWNERHISTORY(#5,#6,$,.ADDED.,1549899150,$,$,0);
#3=IFCPERSON($,'Esser','Sebastian',$,$,$,$,$);
#4=IFCORGANIZATION($,'Technical University of Munich',$,$,$);
#5=IFCPERSONANDORGANIZATION(#3,#4,$);
#6=IFCAPPLICATION(#4,'1.0','TUM_CMS_SE','notDefined');

#7=IFCUNITASSIGNMENT((#8,#9,#10,#11));
#8=IFCSIUNIT(*,.LENGTHUNIT.,$,.METRE.);
#9=IFCSIUNIT(*,.PLANEANGLEUNIT.,$,.RADIAN.);
#10=IFCSIUNIT(*,.AREAUNIT.,$,.SQUARE_METRE.);
#11=IFCSIUNIT(*,.VOLUMEUNIT.,$,.CUBIC_METRE.);

/* site and alignment placement */
#12=IFCLOCALPLACEMENT($,#13);
#13=IFCAXIS2PLACEMENT3D(#14,$,$);
#14=IFCCARTESIANPOINT((0.,0.,0.));

/* representation context is necessary to have geometric product representations */
#15=IFCGEOMETRICREPRESENTATIONCONTEXT($,'Model',3,$,#13,$);

/* -- setup a simple IfcSite containing the products and the alignment curve */
#16=IFCSITE('3_lzWZ4ll1xBtgb_k89bIG',#2,'AlignmentSite','Samples for IfcLocalPlacement and IfcLinearPlacement',$,#12,$,$,$,$,$,0.,$,$);

#17=IFCRELAGGREGATES('1oEWrejW14$hUYRDBPoxmo',#2,$,$,#1,(#16));
#18=IFCRELCONTAINEDINSPATIALSTRUCTURE('2FzbCnjPP0pOSTW0cCcjnt',#2,$,$,(#19,#90,#100,#110,#120),#16);
```



FZKViewer x64 V 5.0 - [SimpleLinearPlacement.ifc]

File View Representations Display Navigation Query Model Transformations Extras Window ?

LinearPlacement Sample
- AlignmentSite
  - IfcAlignment [1]
    - sampleAlignment
  - IfcBuildingElementProxy [4]
    - linear positioned in arc segment
    - euclidian positioned
    - linear positioned
    - euclidian and rotated positioned

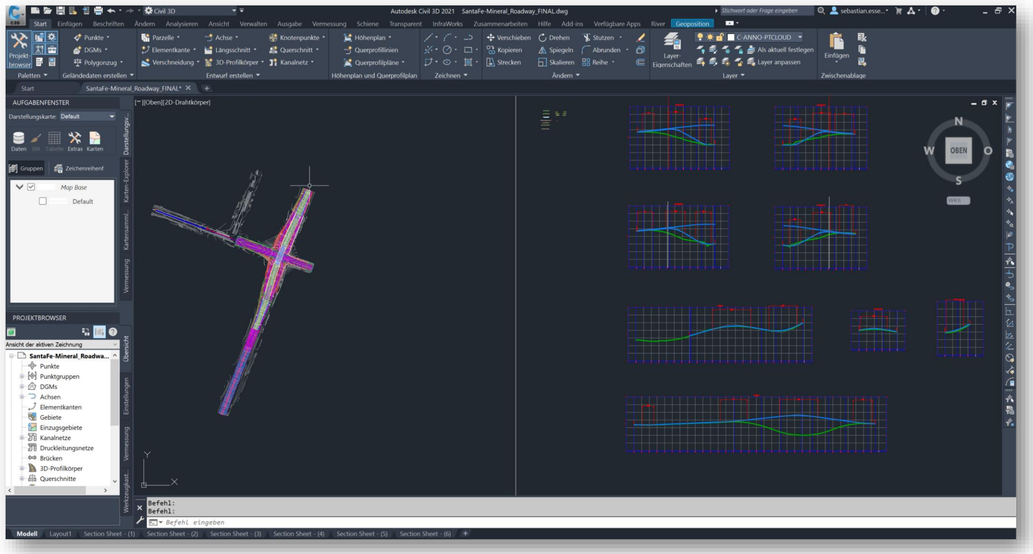
Elements Layers
- IFC
  - IfcAlignment
  - IfcBuildingElementProxy
  - IfcProject
  - IfcSite

SimpleLinearPlacement.ifc - IFC4X1,

3D View

Ready · NUM

- **Test mit Realdaten**



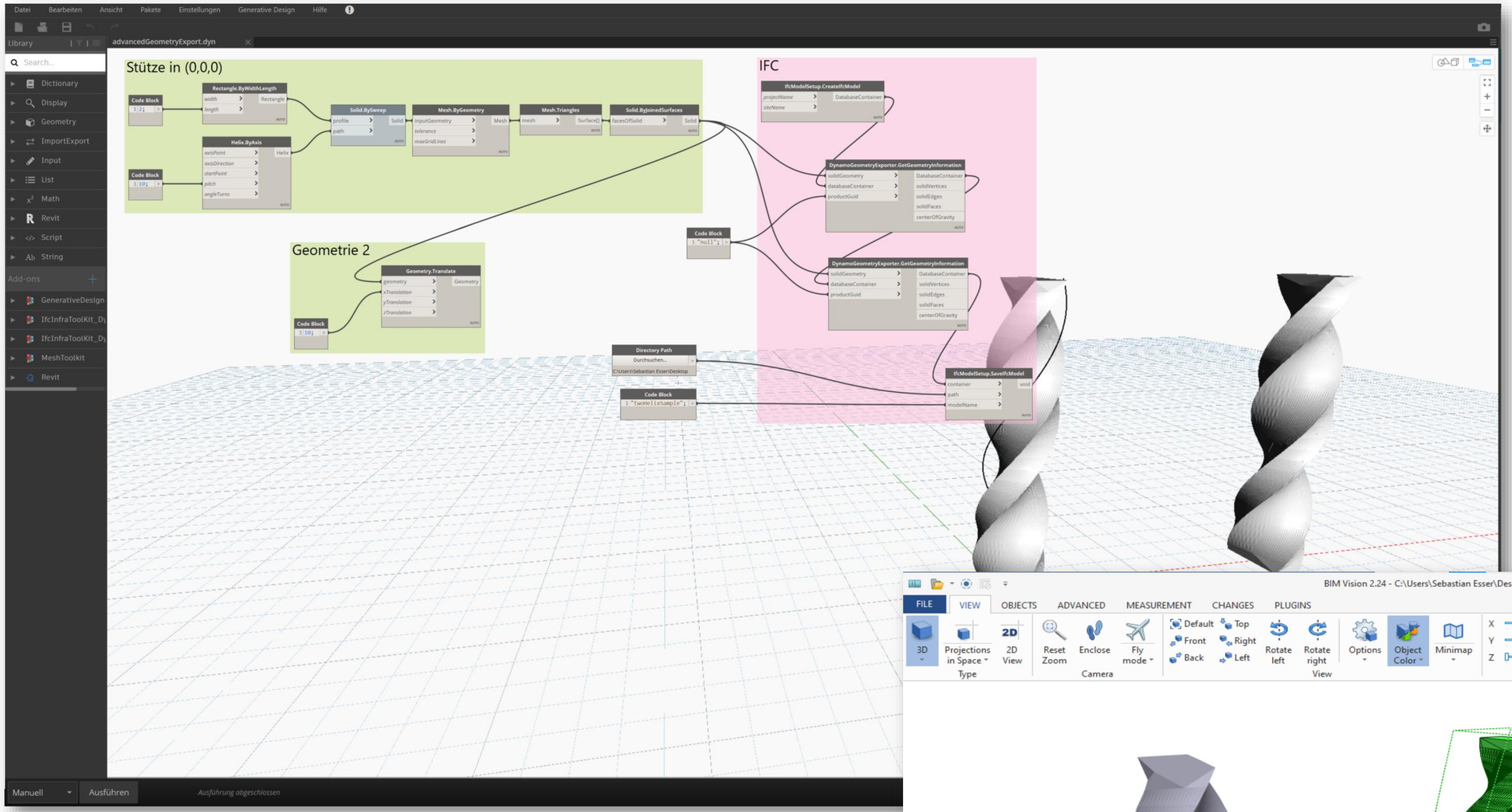
Autodesk Civil 3D 2021 SantaFe-Mineral_Roadway_FINAL.dwg

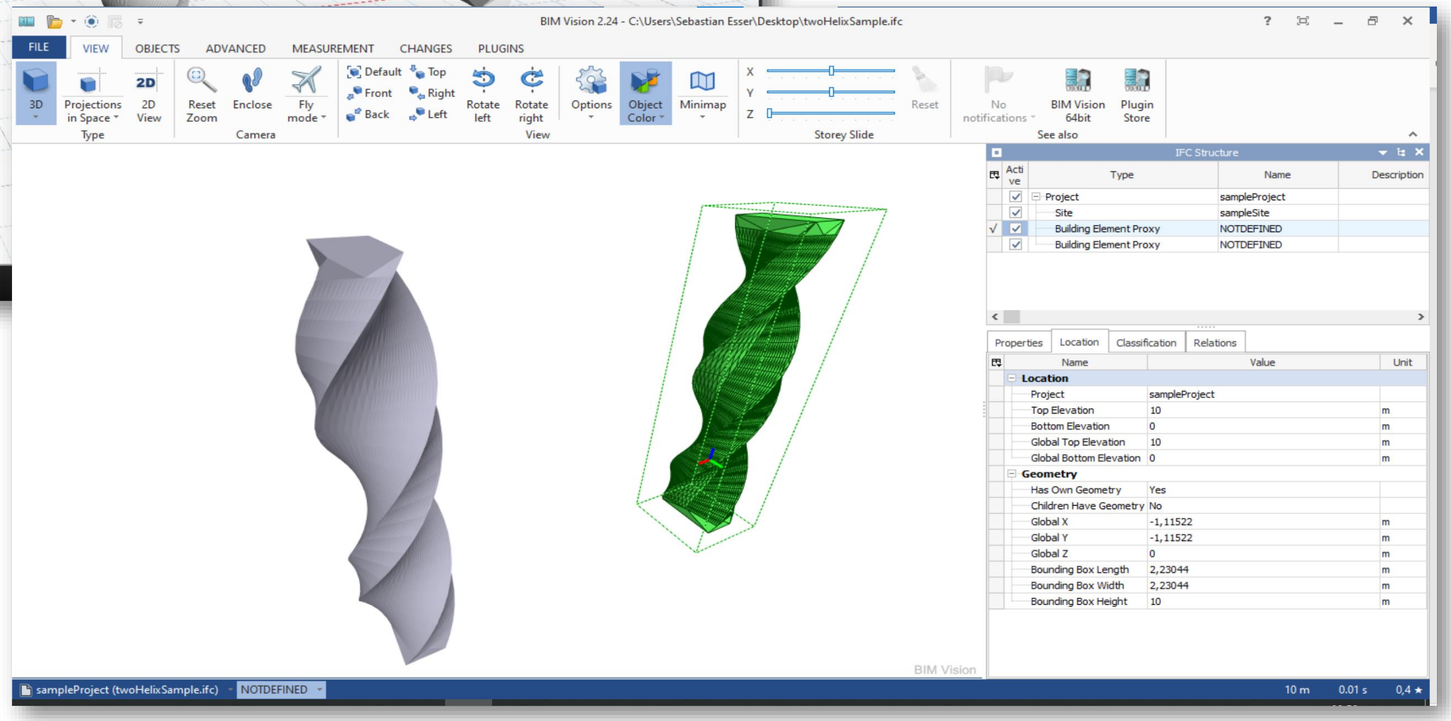
AUFGABENFENSTER · PROJEKTBROWSER

SantaFe-Mineral_Roadwa...
- Punkte
- Punktgruppen
- DGMs
- Achsen
- Elementkanten
- Gebiete
- Einzugsgebiete
- Kanalnetze
- Druckleitungsnetze
- Brücken
- 3D-Profilkörper
- Querschnitte

Befehl:
Befehl:
Befehl eingeben

Modell · Layout1 · Section Sheet - (1) · Section Sheet - (2) · Section Sheet - (3) · Section Sheet - (4) · Section Sheet - (5) · Section Sheet - (6)


Datei
Bearbeiten
Ansicht
Pakete
Einstellungen
Generative Design
Hilfe
Library
advancedGeometryExport.dyn
Search...
Dictionary
Display
Geometry
ImportExport
Input
List
Math
Revit
Script
String
Add-ons
GenerativeDesign
IfcInfraToolKit_Dy
IfcInfraToolKit_Dy
MeshToolkit
Revit
Stütze in (0,0,0)
Rectangle.ByWidthLength
Solid.BySweep
Mesh.ByGeometry
Mesh.Triangles
Solid.BySolidSurfaces
Helix.ByAxis
IFC
IfcModelSetup.CreateIfcModel
DynamoGeometryExporter.GetGeometryInformation
Geometrie 2
Geometry.Translate
Directory Path
IfcModelSetup.SaveIfcModel
Manuell
Ausführen
Ausführung abgeschlossen


BIM Vision 2.24 - C:\Users\Sebastian Esser\Desktop\twoHelixSample.ifc
FILE
VIEW
OBJECTS
ADVANCED
MEASUREMENT
CHANGES
PLUGINS
3D
Projections in Space
2D View
Type
Reset Zoom
Enclose
Fly mode
Camera
Default
Top
Front
Right
Back
Left
Rotate left
Rotate right
View
Options
Object Color
Minimap
X
Y
Z
Reset
Storey Slide
No notifications
BIM Vision 64bit
Plugin Store
See also
IFC Structure
Active
Type
Name
Description
Project
sampleProject
Site
sampleSite
Building Element Proxy
NOTDEFINED
Building Element Proxy
NOTDEFINED
Properties
Location
Classification
Relations
Name
Value
Unit
Location
Project
sampleProject
Top Elevation
10
m
Bottom Elevation
0
m
Global Top Elevation
10
m
Global Bottom Elevation
0
m
Geometry
Has Own Geometry
Yes
Children Have Geometry
No
Global X
-1,11522
m
Global Y
-1,11522
m
Global Z
0
m
Bounding Box Length
2,23044
m
Bounding Box Width
2,23044
m
Bounding Box Height
10
m
BIM Vision
sampleProject (twoHelixSample.ifc)
NOTDEFINED
10 m
0,01 s
0,4

Veröffentlichungen und weitere Informationen

Begleitung der internationalen Standardisierungsprojekte IFC-Road & IFC-Rail

(ARGE IFCINFRA im Auftrag des Bundesministeriums für Verkehr und digitale Infrastruktur)

Begleitung der internationalen
Standardisierungsprojekte
IFC-Road & IFC-Rail

Abschlussbericht Gesamtprojekt

Im Auftrag des Bundesministeriums für Verkehr und digitale Infrastruktur.

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Datum: 07.09.2020

Begleitung der internationalen
Standardisierungsprojekte
IFC-Road & IFC-Rail

Abschlussbericht AP4: Validierung des Datenmodells

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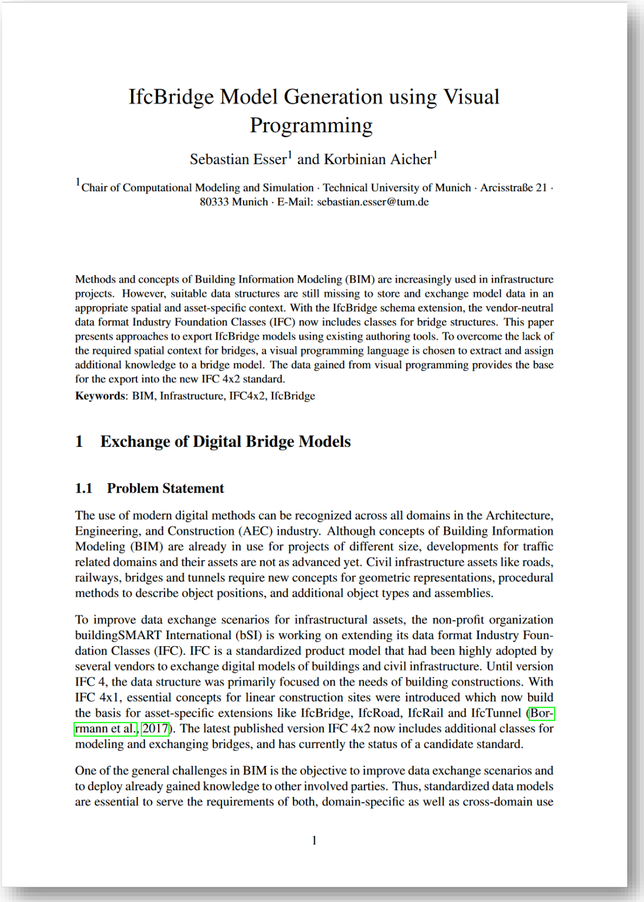
Datum: 30.04.2020

IfcBridge Model Generation using Visual Programming

Esser, S. & Aicher, K. (2019) Proc. Of the 31st Forum Bauinformatik, Berlin



IfcBridge Model Generation using Visual Programming

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Methods and concepts of Building Information Modeling (BIM) are increasingly used in infrastructure projects. However, suitable data structures are still missing to store and exchange model data in an appropriate spatial and asset-specific context. With the IfcBridge schema extension, the vendor-neutral data format Industry Foundation Classes (IFC) now includes classes for bridge structures. This paper presents approaches to export IfcBridge models using existing authoring tools. To overcome the lack of the required spatial context for bridges, a visual programming language is chosen to extract and assign additional knowledge to a bridge model. The data gained from visual programming provides the base for the export into the new IFC 4x2 standard.

Keywords: BIM, Infrastructure, IFC4x2, IfcBridge

1 Exchange of Digital Bridge Models

1.1 Problem Statement

The use of modern digital methods can be recognized across all domains in the Architecture, Engineering, and Construction (AEC) industry. Although concepts of Building Information Modeling (BIM) are already in use for projects of different size, developments for traffic related domains and their assets are not as advanced yet. Civil infrastructure assets like roads, railways, bridges and tunnels require new concepts for geometric representations, procedural methods to describe object positions, and additional object types and assemblies.

To improve data exchange scenarios for infrastructural assets, the non-profit organization buildingSMART International (bSI) is working on extending its data format Industry Foundation Classes (IFC). IFC is a standardized product model that had been highly adopted by several vendors to exchange digital models of buildings and civil infrastructure. Until version IFC 4, the data structure was primarily focused on the needs of building constructions. With IFC 4x1, essential concepts for linear construction sites were introduced which now build the basis for asset-specific extensions like IfcBridge, IfcRoad, IfcRail and IfcTunnel (Borrmann et al., 2017). The latest published version IFC 4x2 now includes additional classes for modeling and exchanging bridges, and has currently the status of a candidate standard.

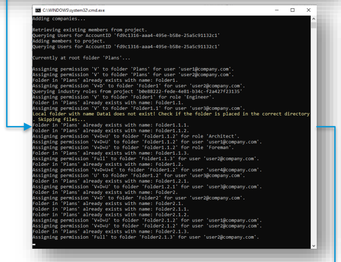
One of the general challenges in BIM is the objective to improve data exchange scenarios and to deploy already gained knowledge to other involved parties. Thus, standardized data models are essential to serve the requirements of both, domain-specific as well as cross-domain use

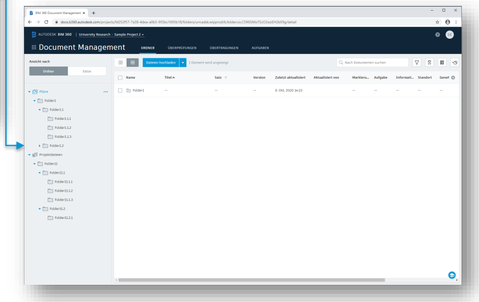
1

Recap

- **BIM360 Setup Tool**

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	project_name	project_type	root_folder	level_1	level_2	level_3	permission	role_permission	user_email	industry_role	company	company_trade	local_folder
2	Sample Project	Office	Plans				V		user1@company.com	Architect, Engineer	Company1	Communications	
3							V		user2@company.com	Foreman, Executive	Company2	Architecture	
4				Folder1			V+D		user2@company.com				
5							V	Engineer					
6					Folder1.1		V		user3@company.com	Estimator	Company3	Electrical	Data1
7						Folder1.1.1							
8						Folder1.1.2	V+D+U	Architect	user1@company.com				
9							V+D+U	Foreman					
10						Folder1.1.3	Full		user2@company.com				
11					Folder1.2		V+D+U+E		user4@company.com	BIM Manager	Company2		
12							U		user3@company.com				
13						Folder1.2.1	V+D+U		user3@company.com				
14				Folder2			V+D		user2@company.com				
15					Folder2.1								
16						Folder2.1.1							
17						Folder2.1.2	V+D+U		user1@company.com				
18							V+D+U		user2@company.com				
19						Folder2.1.3	Full		user2@company.com				
20					Folder2.2		V+D+U+E		user4@company.com				
21							U	Engineer					
22						Folder2.2.1	V+D+U		user3@company.com				
23			Project Files				V		user1@company.com				
24							V		user2@company.com				
25				Folder11			V+D		user2@company.com				
26					Folder11.1		V		user3@company.com				Data2
27						Folder11.1.1							
28						Folder11.1.2	V+D+U		user1@company.com				
29							V+D+U		user2@company.com				
30						Folder11.1.3	Full		user2@company.com				
31					Folder11.2		V+D+U+E		user4@company.com				
32							U		user3@company.com				
33						Folder11.2.1	V+D+U		user3@company.com				
34				Folder22			V+D		user2@company.com				
35					Folder22.1								
36						Folder22.1.1							
37						Folder22.1.2	V+D+U		user1@company.com				
38							V+D+U		user2@company.com				
39						Folder22.1.3	Full		user2@company.com				
40					Folder22.2		V+D+U+E		user4@company.com				
41							U		user3@company.com				
42						Folder22.2.1	V+D+U		user3@company.com				





- **IfcInfraToolkit**