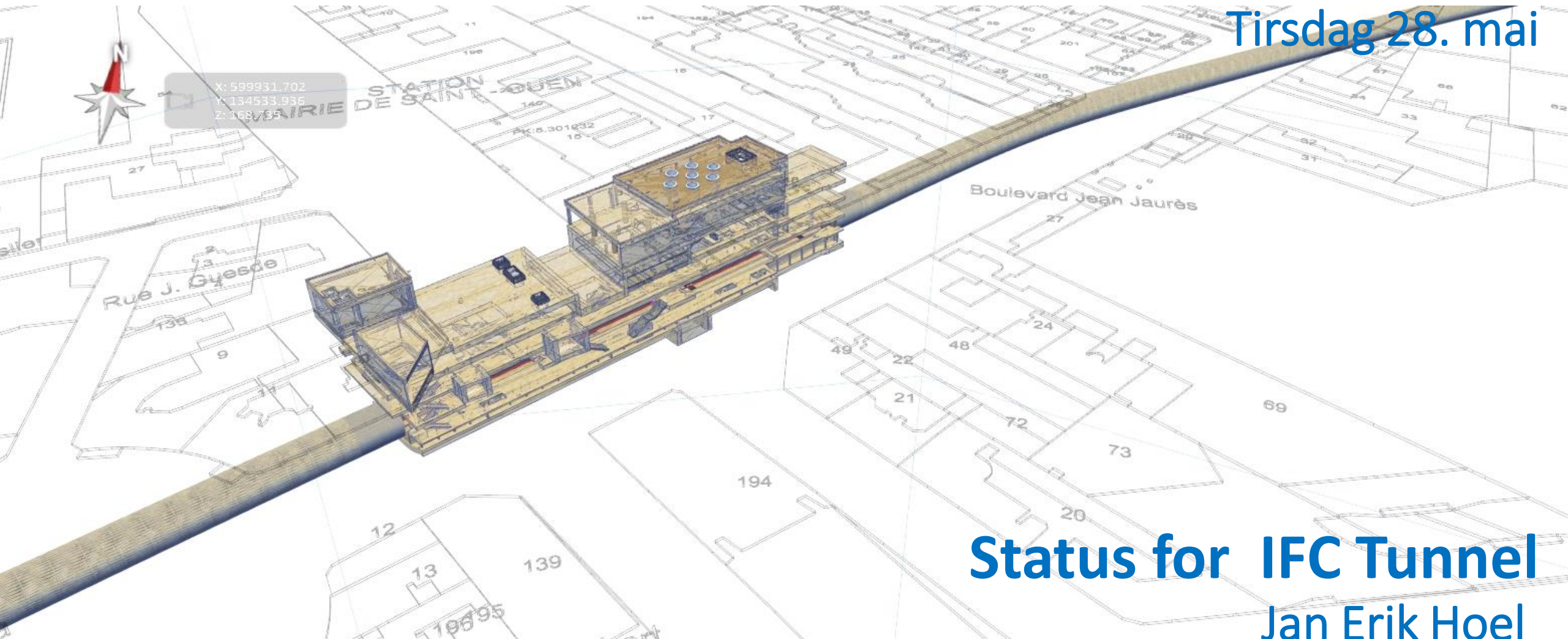




Digital temakveld 2024

Tirsdag 28. mai



Status for IFC Tunnel

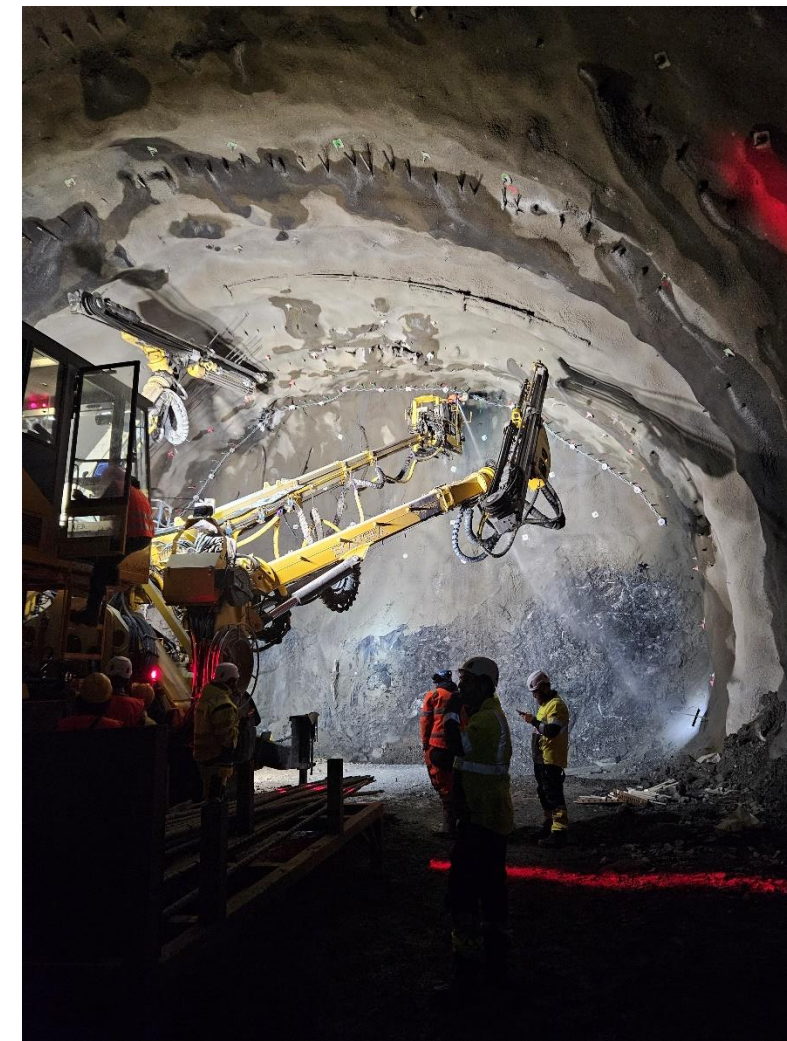
Jan Erik Hoel



Agenda

- Prosjektdeltakere og prosessen
- Kravinnsamling
- Konseptuell modell
- Viktigste aspekter med skjema-utvidelsen
- Geometriske tillegg
- Uttestingsprosjektet

Ifc-for-Tunnelling (Ifc4-T) – Besøk på Vestkorridoren





Ifc-4-T – Bidragsytere 2020-2024

Infrastruktureiere:

- ANDRA (F)
- CFF-SBB (CH)
- TVK (S) / FTIA (FIN)

Geoteknikk og design ingeniører:

- IC-ELEA (SLO)
- GEODATA (I)
- ILF (CH)
- LOMBARDI Grp (CH)
- OYO (JPN)
- SEQUENT-BentleySystems (NZ)

Nasjonale organisasjoner:

- DGITM-CETU (F)
- NFF (N)**
- PTC (P)

Forskning og utviklingsorganisasjoner:

- MINnD (F)
- RUB (D) / TUM (D)
- Univ. of Florida (USA) / Univ. of Loeben (A) / Univ. of SP (BR)

Samarbeide med internasjonale organisasjoner:

- ITA – Modellering av tunneler
- IAEG – Modellering av ingeniørgeologi
- OGC/ISSMGE – OpenGIS Consortium

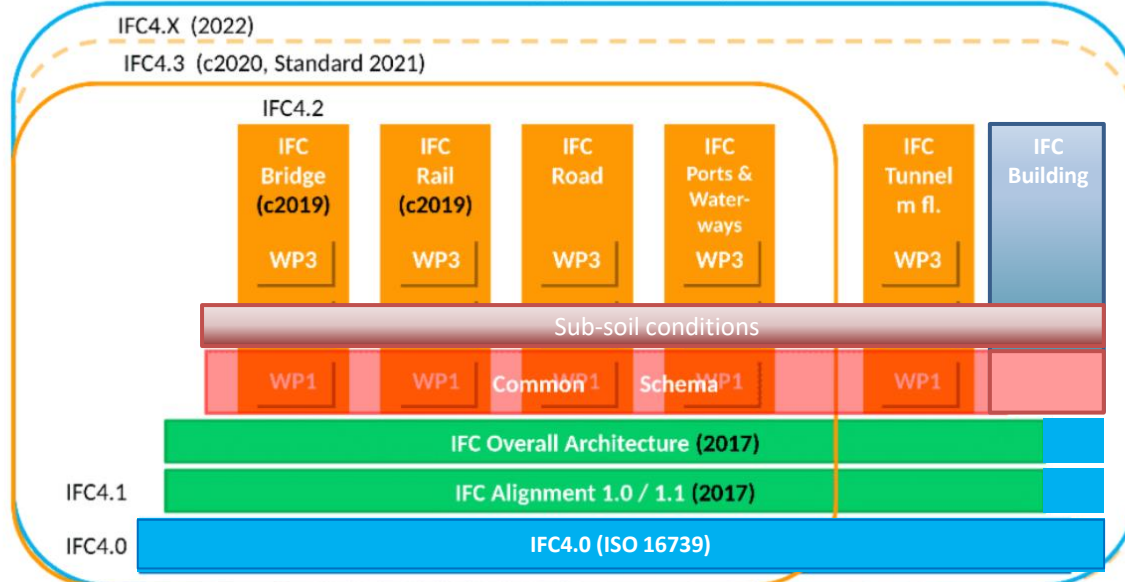
3x domeneekspert team
1x Ifc ekspert team

Σ = 55+ personer (“in-kind” 1.5m€)

bSI – IFC/ISO for infrastruktur prosjekter



IFC Next Generation (bSI Technical roadmap, published shortly)

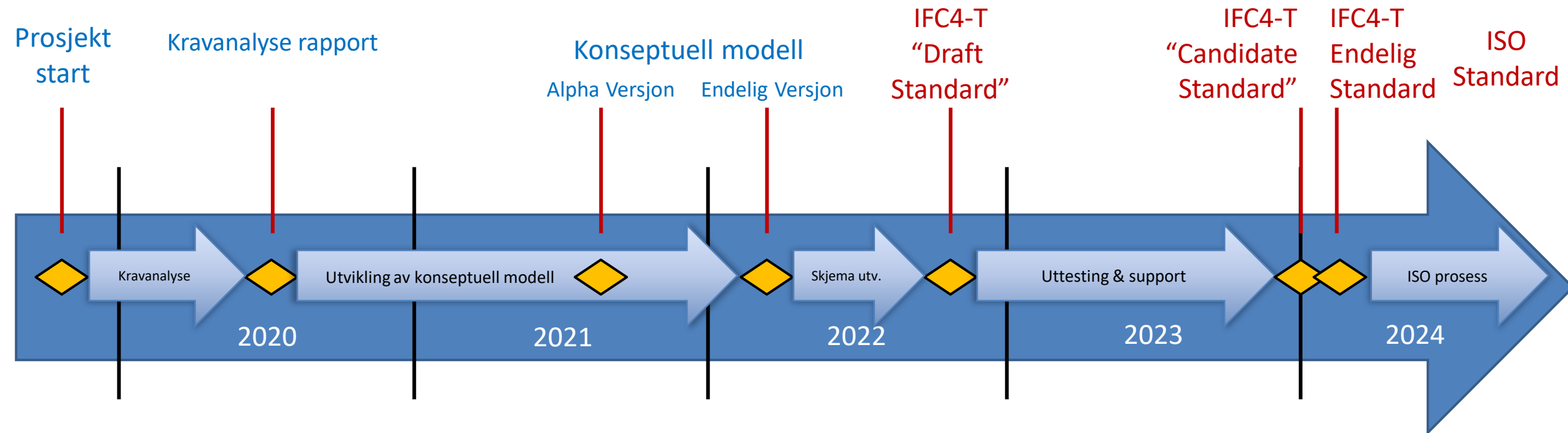


ETT samlet skjema for bygget miljø



ISO 16739 IFC inkl. IFC4.3

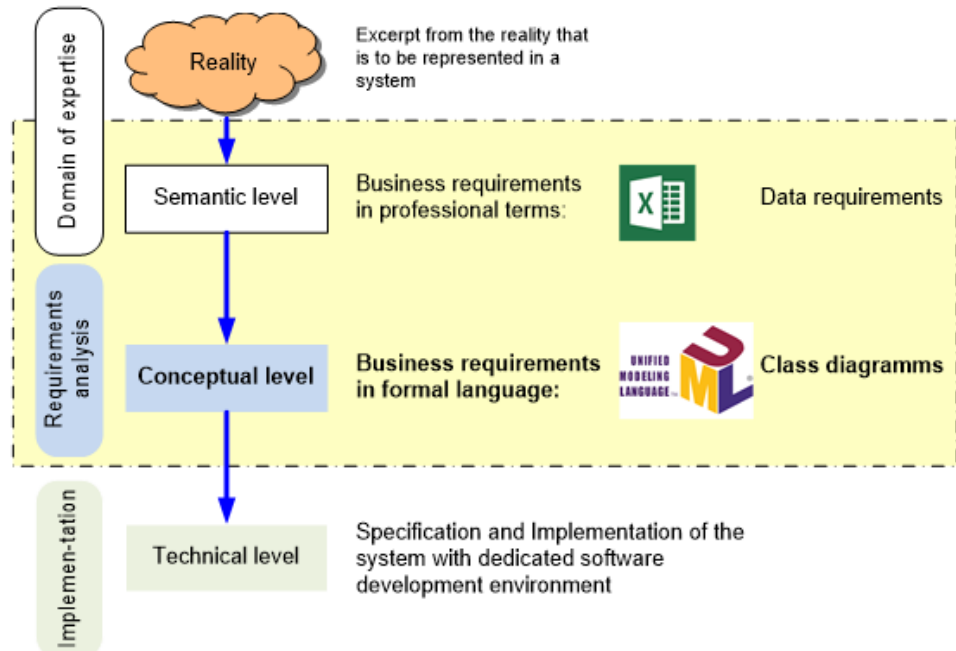
Ifc-4-T – Prosjekt framdrift



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

IfcTunnel – Brukerhistorier

Geologi/geoteknikk



Simuleringer og byggefaser

Domain conceptual model

Anbud

Bygging og statusoppfølging

Overlevering

- Initial state modelling	High Priority
- Geologic modelling	High Priority
- Geotechnical modelling for design	High Priority
- Geotechnical modelling for construction	High Priority
- Exchange of alignment and major road/railway parameters	High Priority
- Technical visualization	High Priority
- Realistic Visualization	Low Priority
- Safety visualization	Low Priority
- Design coordination	High Priority
- Design to design w. reference models	High Priority
- Design to design w. full model logic	Out of Scope
- Structural & geomechanical analysis	Low Priority
- Air flow simulation	Low Priority
- Standards compliance	Low Priority
- Quantity take-off	High Priority
- Construction sequencing	High Priority
a - Design to tender: Construction Model	High Priority
b - Design to tender: Geotechnical Model	High Priority
- Design to construction - DONE	High Priority
- Prefabrication	Low Priority
a - Progress monitoring	High Priority
b - Geological monitoring - DONE	High Priority
c - Scanning during construction	Low Priority
d - Quantity determination for billing / payment	High Priority
- Machine guidance & control	Low Priority
- Damages recording	Low Priority
- Settlement monitoring	Low Priority
- Handover to GIS	High Priority
- Handover to AM	High Priority



IfcTunnel – Krav konsensus

Revisjonsprosessen for krav

3 måneder/ 10 land

200+ kommentarer/forslag

⇒ Justerte krav

Feedback:

ITA I AEG DACH F I JPN N NZ S US

Subjects:

- Geometry & geopositioning
- Spatial structure & project structure
- Geology & geotechnics
- Excavation
- Excavation support
- Lining & water proofing
- Tunnel subsystems

	X	X	X	X	X	X	X	X	-	X
	X	-	X	X	X	X	X	-	X	-
	X	-	X	X	X	X	X	-	X	-
	X	-	X	X	X	X	X	-	X	-
	X	-	X	X	X	-	-	-	-	-

Chapter	Subject	Page	Date	Comm. nbr	Comments
9	Excavation requirements	135			
9.1	Overview				
11.2	Systems required during construction	136			
11.3	Existing Ifc4.3 objects vs specific IfcTunnel objects	137	22/02/2021		
11.3.1	Existing Ifc Railway objects	138			
11.3.2	Existing IfcRoad objects	143			
11.3.3	IFC4 (buildings) objects	145			
11.4	Ventilation	145	22/02/2021		
11.4.1	Ventilation systems under tunnel operation	145	19/02/2021		
11.4.2	Ventilation systems during tunnel construction	147			
11.4.3	Main components and characteristics	149			
11.5	Power supply – High voltage	151	22/02/2021		
11.5.1	Power supply under tunnel operation	151	19/02/2021		
11.5.2	Power supply during tunnel construction	151			
11.5.3	Main components and characteristics	152			
11.6	Energized equipments	157			
11.6.1	Energized equipments under tunnel operation	157			
11.6.2	Energized equipments during tunnel construction	157			
11.6.3	Main components and characteristics	155	19/02/2021		
11.7	Drainage	158	22/02/2021		
10.2	Ground improvement and water control	116			
10.2.1	Conventional tunnelling	116			
10.2.2	Mechanised tunnelling	119	28/01/2021		Permanent ground treatment around the tunnel alignment could be integrated in the tool. JetGrouting / injections for entry / exit points to stations or shafts or for treatment inside a station box to stabilize the ground and allow TBM passage through the soil before excavation

Chapter	Subject	Page	Date	Comm. nbr	Comments
3	Use cases	10	22/02/2021		
		10&11	22/02/2021		
		12	22/02/2021		
11.1	Systems, sub-systems, components & characteristics	135			l'objectif est aussi d'assurer la sécurité des usagers Un chapitre spécifique "tests et essais" serait utile Un chapitre spécifique Maintenance des équipements serait utile La rénovation n'est pas traitée. Comment vont être abordés les contrôles sur un ensemble de système ? (séquences particulière de sécurité par exemple) Et les contraintes réglementaires ? (extincteurs, détection incendie des bâtiments, installations électriques...) Pour les équipements retrouver ces 4 phases (design/installation/tests/maintenance dans 4 chapitres distincts serait utile
11.2	Systems required during construction	136			Tout ce qui concerne les dispositions de construction de l'ouvrage (éclairage de chantier, ventilation de chantier, etc) serait mieux dans un chapitre spécifique qui serait intégré dans la partie GC, mais pas dans la partie Equipements
11.3	Existing Ifc4.3 objects vs specific IfcTunnel objects	137	22/02/2021		Je partage la remarque en terme d'entree la phase con concepteurs et l'r la logistique de r (maintenance, Ces comment sous-système en fait
11.3.1	Existing Ifc Railway objects	138			
11.3.2	Existing IfcRoad objects	143			
11.3.3	IFC4 (buildings) objects	145			To corr Mabye they - m - c - f
11.4	Ventilation	145	22/02/2021		
11.4.1	Ventilation systems under tunnel operation	145	19/02/2021		
11.4.2	Ventilation systems during tunnel construction	147			
11.4.3	Main components and characteristics	149			
11.5	Power supply – High voltage	151	22/02/2021		
11.5.1	Power supply under tunnel operation	151	19/02/2021		
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11.6.1	Energized equipments under tunnel operation	157			
11.6.2	Energized equipments during tunnel construction	157			
11.6.3	Main components and characteristics	155	19/02/2021		
11.7	Drainage	158	22/02/2021		

Chapter	Subject	Page	Date	Comm. nbr	Comments
3	Use cases	10	22/02/2021		For UC 1 - Initial State Modelling - Required semantic information for existing structures should include: loads brought to the ground + sensitiveness to displacement
		10&11	22/02/2021		UC 2x - ISO standards for Geotechnics should be mentioned similarly as for UC 15b
		12	22/02/2021		UC 4c - Safety visualization - Would consider Priority medium or high (often requested by customers)
					UC 6b - Design to Design w. full model logic - Not sure whether my understanding is correct, but for me, this cannot be out of scope. Parametric designing of tunnels must be the target. Being able, for example, to model support for electrical appliance (with an "electrical" software) from an axis and civil structure description (from a "tunnel specific software") is mandatory.
					UC 7 - Structural & geomechanical analysis - would consider Priority medium or high
					UC 8a - Air Flow simulation - would consider Priority medium or high
					UC 9 - Standards Compliance - Difficulty might be variable depending on various sub-topics. Some of them might be more easy than others and more interesting, e.g. emergency egress requirements which are already available for buildings, etc.
					UC 10 - Quantity Take Off - I would not consider this as low difficulty due to the multiplicity of classification systems or Costs Breakdown Structures (hence Oses Breakdown Structures) around the world
					UC 12a - Design to Tender Construction Model - I don't see this as a use case with specific requirements in itself, it is more a combination of several use cases.
					UC 12b - Design to Tender - Geotechnical Model - Contractual and risk allocation issues may lead this use case to be highly difficult...
					UC 13 - Design to Construction: Same comment as 12a: It is rather a combination of several use cases.

International Association for Engineering Geology and the Environment

11 March 2021

IAEG C25 - ENGINEERING GEOLOGICAL MODELS

Comments on IFC Tunnel Project Report WP2: Requirements analysis report (RAR)

At the suggestion of Pat McLarin of Sequent, Steve Parry (past Chair) and Fred Byrnes (current Chair) of IAEG Commission 25 prepared these comments.

The aim of the project is stated as "to create and provide the engineering and construction industry with an open BIM data exchange standard capable to exchange and archive tunnel models in a neutral ISO format that is vendor-independent and persistent for the long run" (p7). I.e. its primary focus is on digital data exchange. However, the report is considerably broader and includes, for example geological and geotechnical attributes to be captured as well as discussing visualization.

The report uses the term model and modelling but these are not defined.

The report differs from the IAEG C25 (Parry et al., 2014) approach in that it divides the engineering geological input into two parts, geological and geotechnical.

"This classification can be based on geological categories like e.g., age, stratigraphy and structural tectonic position of lithology ("geological model") or the mechanical material properties and aspects relevant for design and construction ("geotechnical design models")" (p50). Although it is noted that Figure 8-3 uses the term "engineering geological models".

Whilst such definitions of models have been adopted by others, problems with the use of "geological" models for engineering purposes have been documented (Knill 2003, Sullivan 2010) and consequently IAEG C25 (Parry 2014) use the term "Engineering Geological Model (EGM)".

In addition, and more importantly with respect to IFC WP2, C25 divided EGMs into two types, those based on conceptual ideas and those based on observational data. Whilst the term "conceptual model" is used in WP2 a definition is not provided but it does not align with that used in C25.

IAEG C25 (Parry et al., 2014) note that conceptual models are "based on understanding the relationships between engineering geological logs, their likely geometry, and associated distribution based on conceptual ideas and those based on observational data. Whilst the term "conceptual model" is used in WP2 a definition is not provided but it does not align with that used in C25.

This approach and the models formed, are based on concepts formulated from knowledge and experience and are not necessarily related to real three dimensional (3D) space or time".

C25 goes on to state that conceptual models "are typically the first model type generated in a project and are developed from pre-existing information based on geological concepts within a general context of civil engineering. They potentially involve a relatively high degree of uncertainty which is directly related to the type and amount of existing data and the knowledge and experience of those involved. However, when such models are proficiently developed, they provide an extremely powerful tool for appreciating and communicating what is known about a site, what is conjectured and where

IAEG C25 Comments on IFC wp2

1 of 4

IfcTunnel – Kravanalyse rapport

- **Kravanalyserapporten** baserte seg på input fra domeneekspertene.
- Dokumenterte
 - Prioriterte brukerhistorier
 - Prosesser
 - Dataoverføringsscenarier
 - Generelle konsepter
 - Georefering, Geometri, Linjeberegning, ...
 - Detaljert beskrivelse av spesifikke temaer:
 - Geologi/geoteknikk
 - Tunneldriving, sikring, innerkledning
 - Systemer

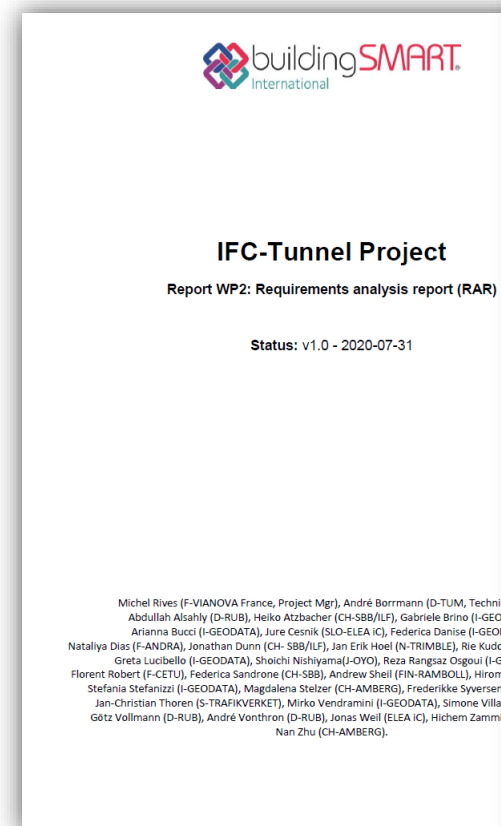
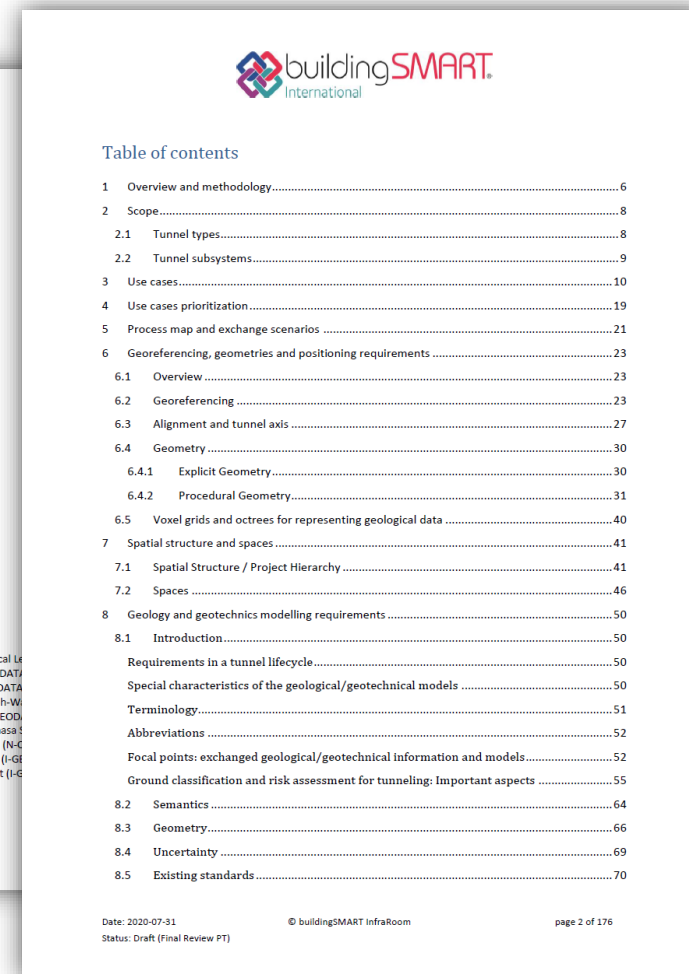



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2.2	Tunnel subsystems..... 9
3	Use cases..... 10
4	Use cases prioritization..... 19
5	Process map and exchange scenarios 21
6	Georeferencing, geometries and positioning requirements 23
6.1	Overview 23
6.2	Georeferencing 23
6.3	Alignment and tunnel axis 27
6.4	Geometry 30
6.4.1	Explicit Geometry..... 30
6.4.2	Procedural Geometry..... 31
6.5	Voxel grids and octrees for representing geological data 40
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	Requirements in a tunnel lifecycle..... 50
	Special characteristics of the geological/geotechnical models 50
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	Abbreviations 52
	Focal points: exchanged geological/geotechnical information and models..... 52
	Ground classification and risk assessment for tunneling: Important aspects 55
8.2	Semantics 64
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Date: 2020-07-31
Status: Draft (Final Review PT)

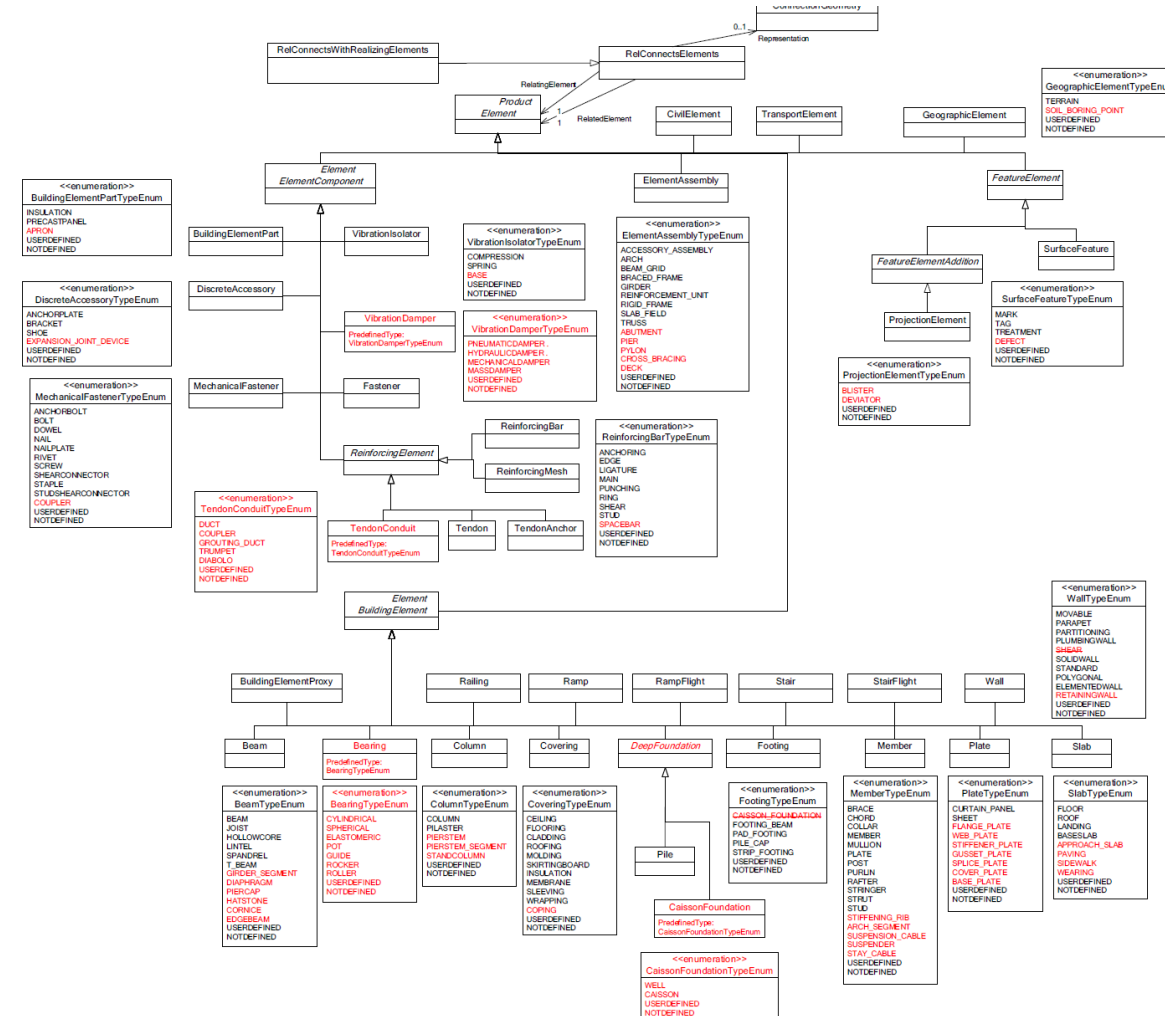
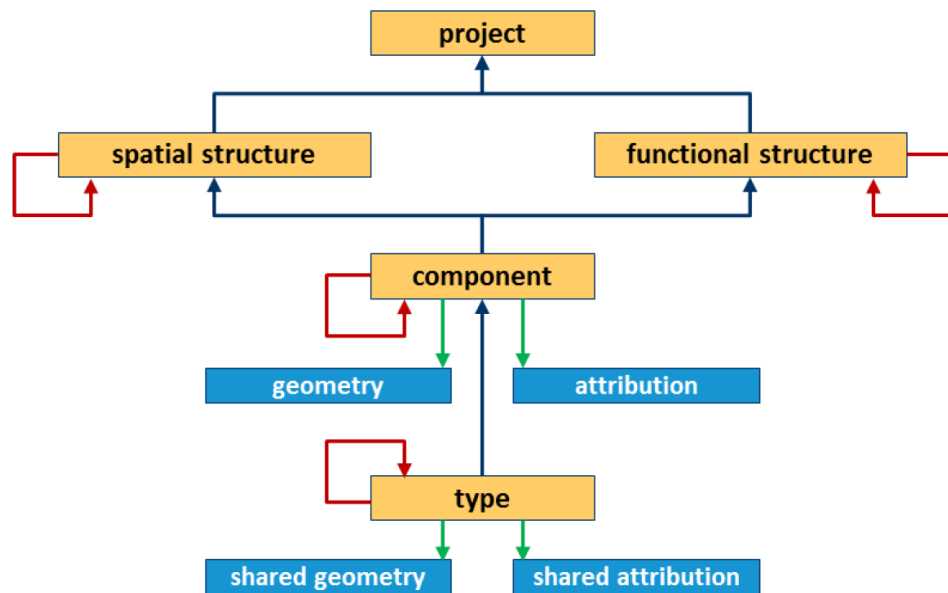
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https://publications.cms.bgu.tum.de/reports/IR-TUN_Requirement-Analysis-Report_v1.0.pdf



IfcTunnel – Konseptuell modell

- UML = Unified Modeling Language
- Standardisert **visuell representasjon** av objektorienterte datamodeller
- Basis for konseptuell modellering

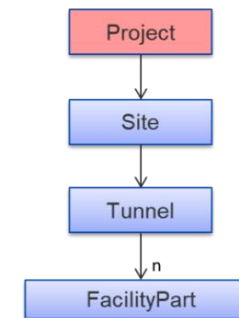
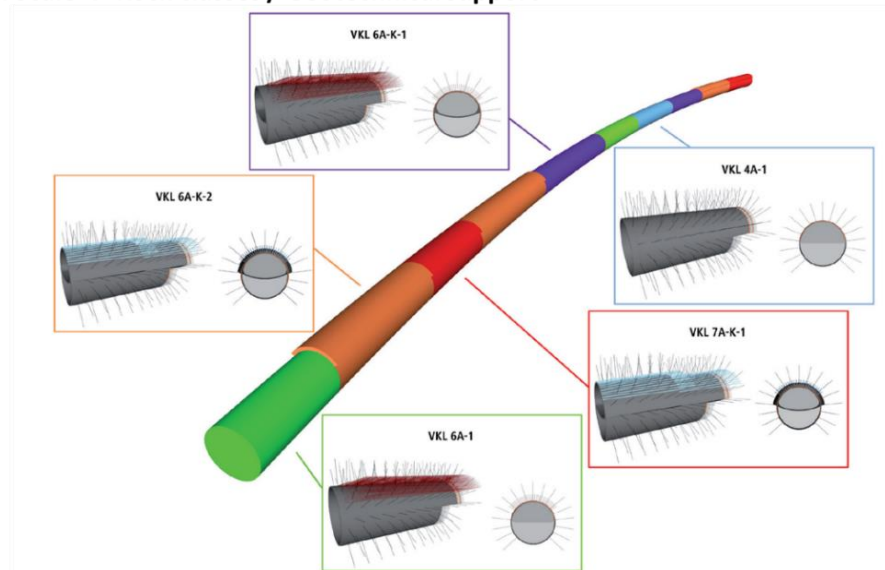


IfcTunnel – Romlig nedbrytning

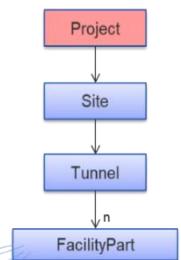
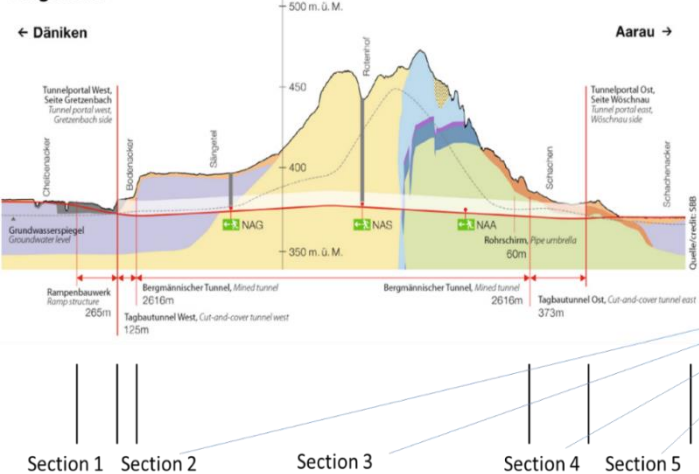
■ **Fleksibel nedbrytningsstruktur krever:**

- Ulike skalaer:
 - Stor / medium / liten
- Ulike retninger:
 - Langsgående / på tvers / vertikalt

Medium Scale → Rock classes / Geotechnical support



Large Scale



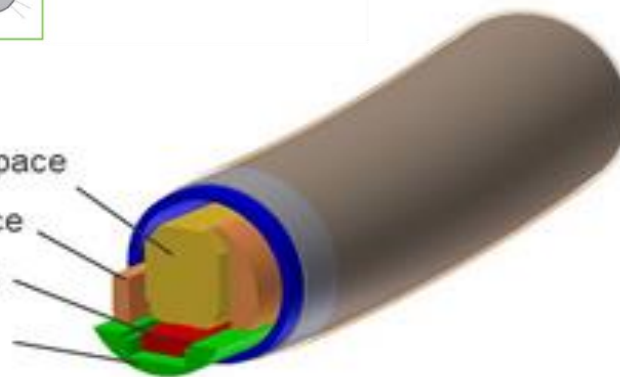
Credit/Source: SBB

ClearanceSpace

ServiceSpace

TrackSpace

FloorSpace





IfcTunnel – Romlige definisjoner

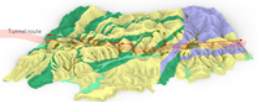
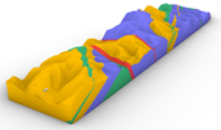
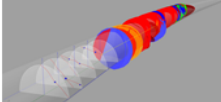
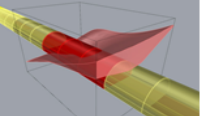
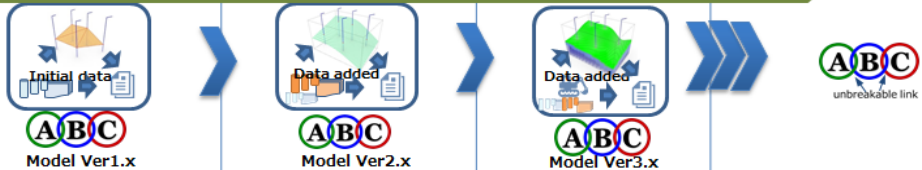


Romlige definisjoner som kan benyttes for beskrive **Tunneldriving-, sikring- og innerkledningsprosesser**

Romlige definisjoner som kan inneholde **systemer og utstyr**

IfcTunnel – Geologi og geoteknikk

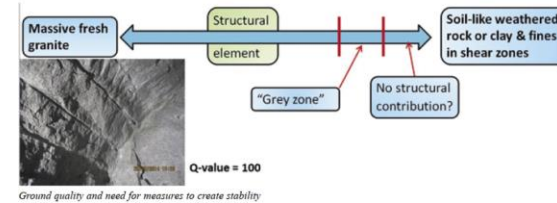
- Geologi/geoteknikk er ikke godt nok definert i IFC4.3 eller av OGC
- Beskrivelse av lag og diskontinuiteter (slepper, sprekker osv)
- Sentrale utfordringer: **Usikkerhet** som fører til **risiko**
- Skiller klart på:
 - Registrerte data: “Bok A”
 - Tolkede data: “Bok B”
 - Prosjekterte tiltak: “Bok C”
- Kobler og harmoniserer mot eksisterende standarder:
 - OGC GeoSciML, DIGGS, AGS

Lifecycle stage	Plan & Investigation	Investigation & Design	Construction	Maintenance
Primary objective of modeling	Tunnel routes / alignment studies (UC 2a)	Tunnel Design (UC 2b, 12b)	Construction management (UC 15b, 2c, 12b)	Measures to deformation and damage (2C)
Model example	 Regional-scale engineering-geological model	 Tunnel-scale engineering-geological model	 Geol. Tunnel Docu./as-built model	 As-built model for specific area
Modeling area	Relatively wide area including potential tunnel routes	Around the tunnel corridor	Around the tunnel excavation	Selection of previous models around zones of interest
Approx. resolution required to the model	>10m mesh	<10m mesh	Down to 0.1m mesh	Down to 0.1m mesh
Input data for modeling Book A: Factual Data	<ul style="list-style-type: none"> • Previously existing data and first project-specific site investigation results 	<ul style="list-style-type: none"> • Pre-existing data • Mainly project-specific site investigation results (including field mapping) 	<ul style="list-style-type: none"> • Pre-existing data • Site investigation results • Geol. tunnel (and other) documentation, additional investigation 	<ul style="list-style-type: none"> • Pre-existing data • Site investigation results • Data obtained during construction • maintenance data
Model content Book B: Interpreted models	<ul style="list-style-type: none"> • Regional topography, geology, hydro-geology, etc. • Engineering-geological aspects to be considered for tunnel route selection (potential hazards) 	<ul style="list-style-type: none"> • Geological conditions and geotechnical design parameters (like rock mass strength, permeability, discontinuity pattern etc.) • Engineering-geological aspects to be considered for tunnel design and construction (potential hazards) 	<ul style="list-style-type: none"> • Encountered geological and geotechnical conditions • Potential hazards during construction 	<ul style="list-style-type: none"> • Relationship among damage area, geotechnical condition and tunnel
Implications Book C: Design solutions and applications based on the interpreted models	<ul style="list-style-type: none"> • Decisions on alignment, land acquisition, etc. 	<ul style="list-style-type: none"> • Ground behaviour, construction method, support measures, ground improvement, system behaviour, excavation classes etc. 	<ul style="list-style-type: none"> • Observation and interpretation of displacements • Adjusted prediction of expected geotechnical conditions • Safety management • Comparison to predicted conditions 	<ul style="list-style-type: none"> • Safety monitoring, routine maintenance works, counter measures for damages etc.
Remarks	<ul style="list-style-type: none"> • The model (B) should be accompanied by the base data (A) to enable an update with new data and to evaluate the model's uncertainty • The implications (C) depend on the model and should be linked to it • Consequently, ABC should be linked as one package and be delivered next phase. 			
Schematic drawing of the inheritance of the geological/Geotechnical models through the life cycle of a tunnel.	<p style="text-align: center;">Model's accuracy, resolution, and reliability increase with update</p> 			

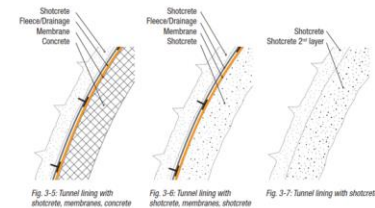
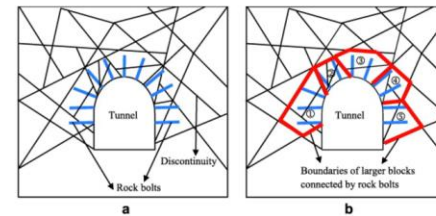


IfcTunnel – Tunneldriving

- Tunneldrivingsmetoder
 - Tunnelboremaskin (TBM)
 - Boring og sprengning
 - “Cut and cover”

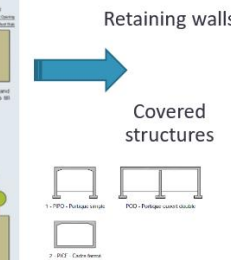
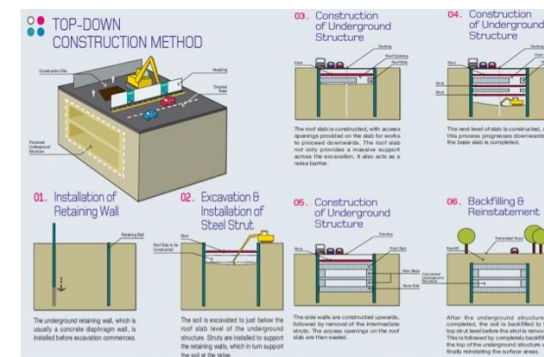
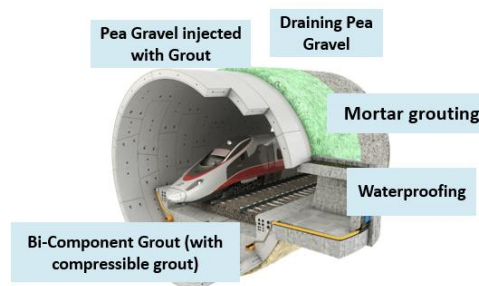
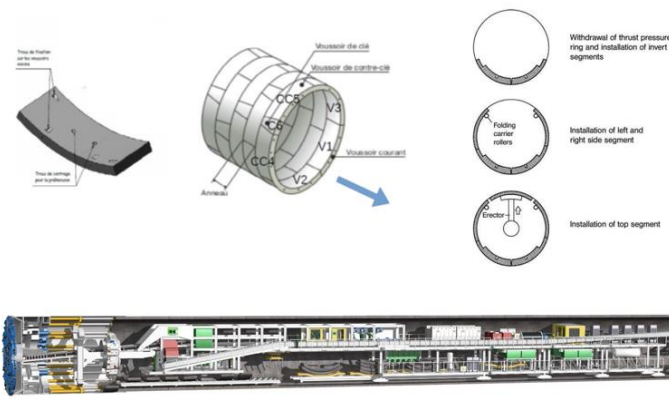


Boring og sprengning

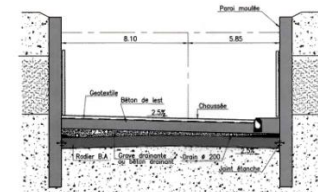


Lining types

TBM



Cut & cover



IfcTunnel – Tekniske systemer

- Ventilasjon
- Brann
- Drenering
- Elektrisitet
 - Lav- og høyspenning
- Sikkerhet og evakuering
- Kommunikasjon



Ventilation

- Civil engineering associated to ventilation
 - Air ducts Civil engineering : galleries, shafts, tunnel ducts, branches
 - Premises, units, factories, central ventilating
 - Arrangements in tunnel, bosses
- Electromechanical
 - Electro-fan (and its control accessories)
 - Accelerator (and its control accessories)
 - Disconnecting devices: registers, motorized hatches, valves, doors
- Sensors
 - Air quality: CO, NOx
 - Air quality: opacimeter
 - Anemometer
 - Tunnel air temperature sensor
 - Weather station
- Other
 - Organs of Acoustic attenuation

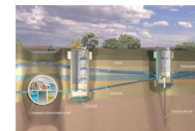


LowVoltage / Energized Equipements

- Power supply
 - High tension
 - Transformation
 - Low tension
 - Wiring
- Lighting
 - Devices
 - Junction box
 - Sensors
 - Runway lights
- Networks
 - Optical Fibre junction box
 - Optical Fibre cable
 - Switch
 - Network Supervisor
- Centralised Technical Management system / Oversight
 - Programmable logic controllers
 - Remote output input module
 - Supervisory server
 - Archiving server
 - Supervision
 - Maintenance station
- Video surveillance
 - Shooting equipment
 - Automatic Incident Detection
 - CCTV system
 - Visualization system
- Emergency Call Network
 - Business Continuity Plan (BCP)
 - Emergency Call Station
 - Server of Emergency Call Station
 - radiating cable
 - Mast
 - Antenna
 - Transmitter / receiver
 - Radio station

Drainage

- Network of Drainage - Sanitation
 - Identification data of drainage-sanitation network
 - Typology of drainage-sanitation network
 - Information of network control
 - Information of network construction (implementation)
 - Information of Network Maintenance (activities)
 - Information of Network dismantling (activities)
 - Transport of effluents
 - Absorption of effluents (terminal)
 - Access to the network (sewer)
 - Management of effluent
- Drained Space
 - Typology of drained space
 - Typology of effluents
 - Liaisons between objects
 - Topological data of collected surface
 - Hydraulic surface data collected
- Water point
 - Typology of water point
 - Data of water point identification
 - Liaison between objects
 - Hydraulic data of water point



HighVoltage / Traction

- Aerial High Voltage
 - Delivery point of Aerial High Voltage
 - Artery of Aerial High Voltage
- Low Voltage Distribution
 - Force Lighting Station / Force Station
 - Low Voltage Distribution
 - Emergency power: Uninterrupted power supply and generator (room for battery and generator)
 - System protection and grounding system
- TRACTION
 - Traction Substation + Separating Station
 - Traction Distribution
 - Traction Current Feedback Circuit
 - Staking energy recovery systems
- Autonomous systems
 - Autonomous production plant
 - Low Voltage Distribution



Fire protection

- Fire Water supply
 - From the public network
 - Water connection point and counting
 - Storage / Cistern
 - Group of Pressurizing
 - Room for Pressurizing Group
- Delivery
 - Description of the network
 - Underground pipe
 - Culvert
 - Overhead line
 - Description of the freeze protection
 - Insulating
 - Electric tracing
 - Axis
 - Pressurizing Pressurizing
 - Device to prevent pressure shocks
 - Pipe (object) / branch of network (for calculation)
 - Canalization (inside)
 - Pipe (interface)
 - Pipeline (ductwork / range)
- Restitution
 - Recess for a fire hydrant or surge
 - Fire hydrant
 - Surge
 - Connector
 - Taps (Product / Range)
 - Instrumentation
 - Electrical tracing
 - Corrosion protection



- Signage and Safety Equipment
 - Closing and signaling
 - Auto evacuation
 - Security niche
- Ventilated local
 - Ventilation ducts
 - Technical premises
 - PAU and possibly sound device
 - Signage (after the tunnel gate to the assembly point)

- Shelters with tracking
 - SAs
 - Waiting area
 - Geometry related to pedestrian traffic (connection with the outside, for users and rescue)
 - Doors
 - Ventilation of the shelter (including overpressure)
 - Ventilation of the path (direct connection with the outside)
 - Lighting
 - PAU
 - Fire resistance
 - PAU
 - Sound system (speaker)
 - Signage (after the tunnel gate to the assembly point)

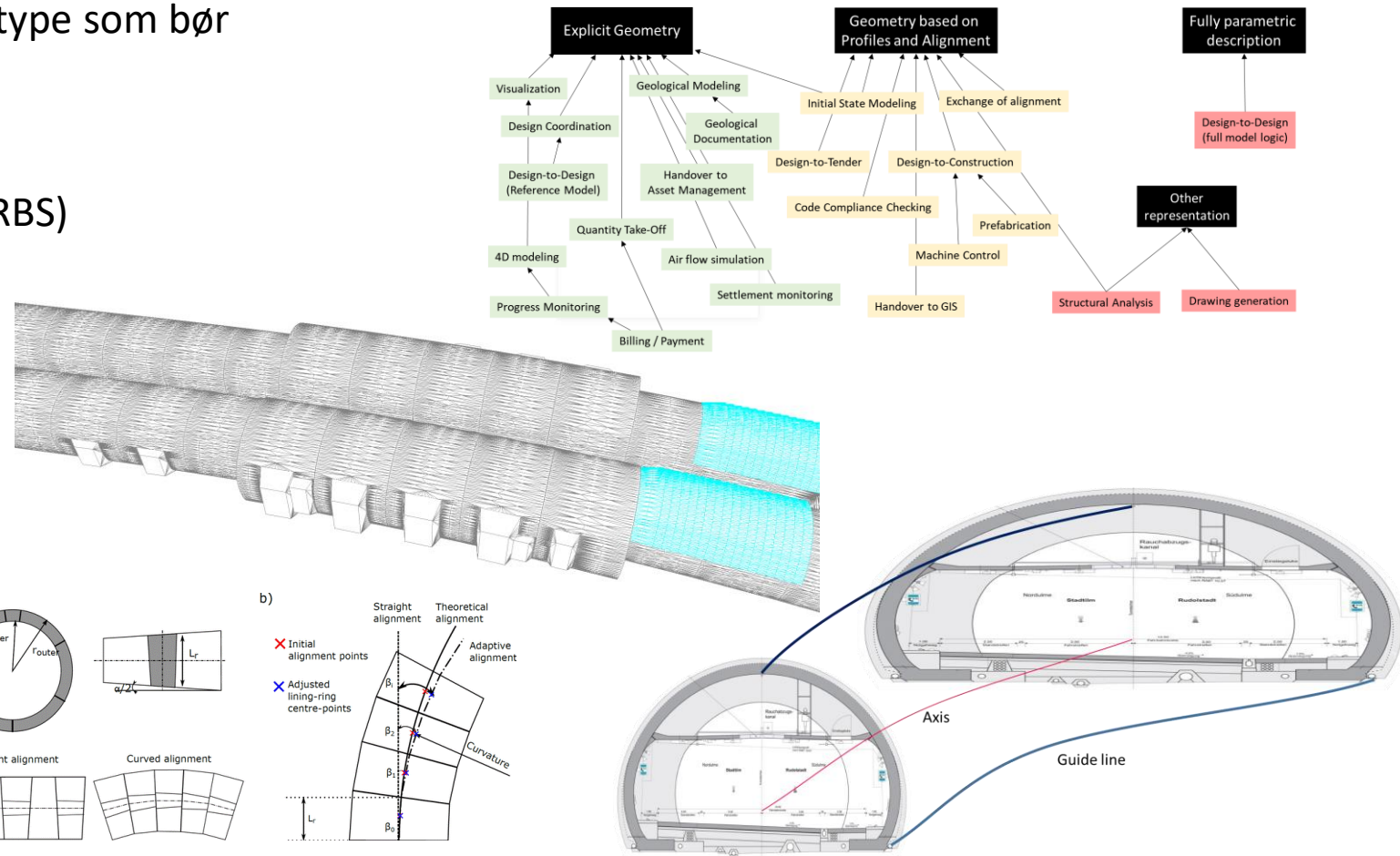
Safety / Evacuation

- Specific equipment in tunnel
 - Flash fire
 - Guide chevron
 - NEBS
- Lighting in case of evacuation
 - Positioning of the flash lights
 - Positioning of the rafters
- Sound system
 - Positioning
 - Characteristics
 - Sirens
 - Sound beacon
- Airlock
 - Dimensions
 - Characteristics
 - Ventilation
 - Doors
- Waiting area
 - Dimensions
 - Characteristics



IfcTunnel – Geometrirepresentasjon

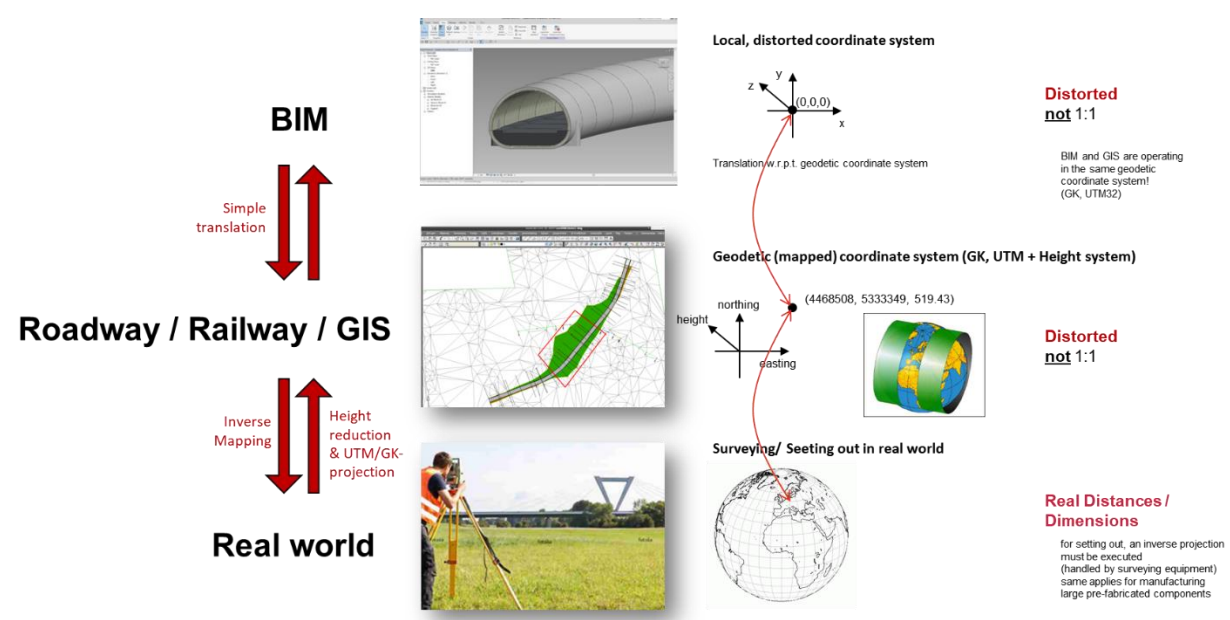
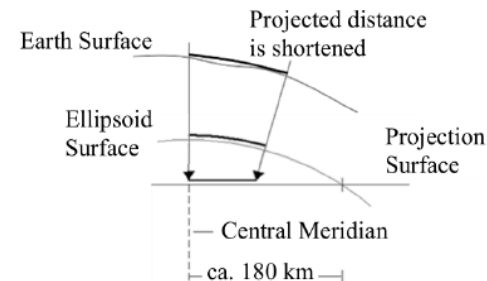
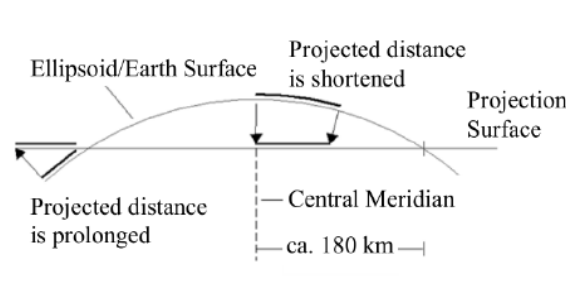
- Brukssituasjonen avgjør hvilken geometritype som bør benyttes.
- Geometritype varianter:
 - Eksplisitt geometri (trianglmodell, NURBS)
 - Prosessert geometri
 - Sweep
 - Boolske operasjoner (CSG)
 - ...
 - Parameterbestemt geometri





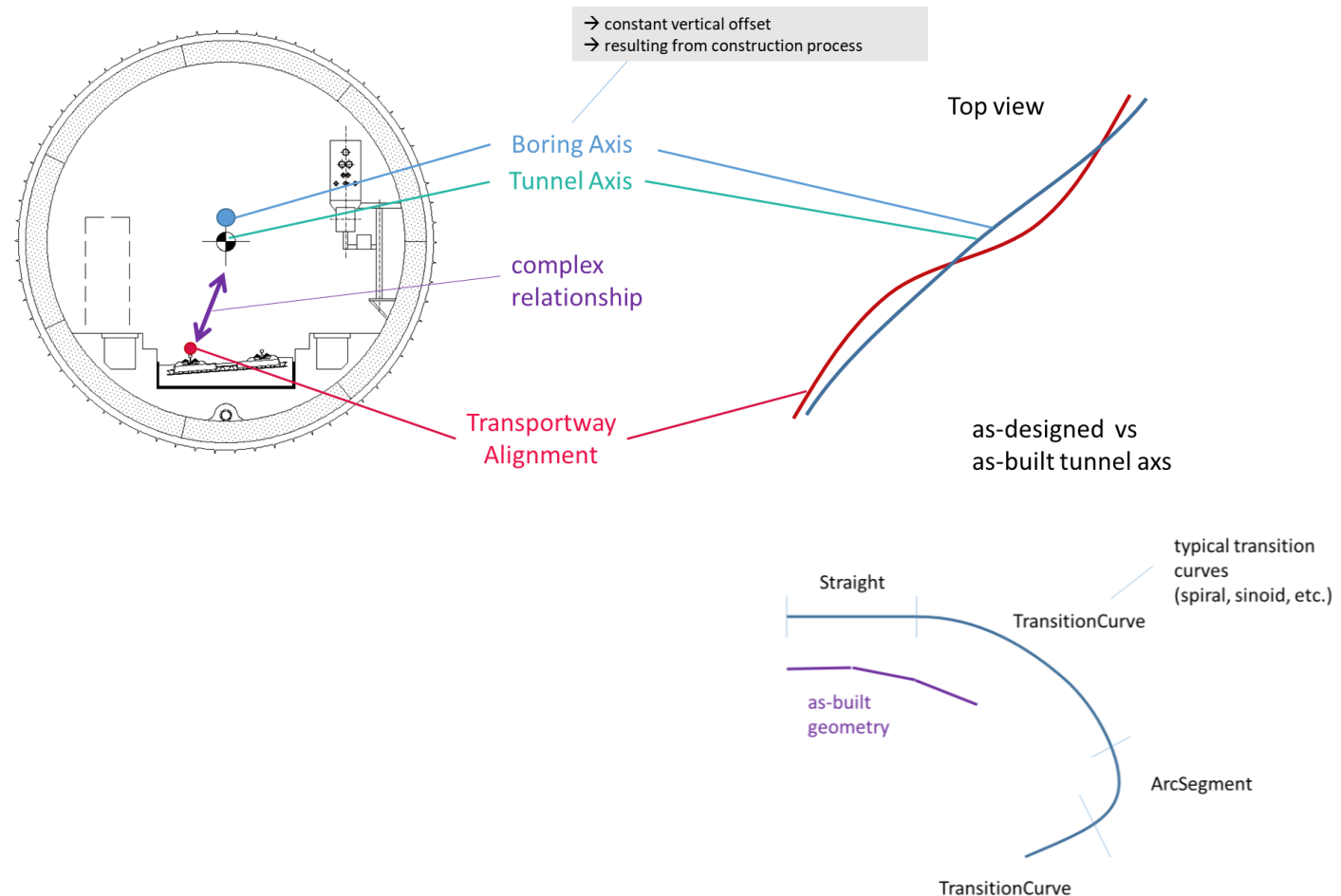
IfcTunnel – Koordinatreferanser

- Lange tunneler er typisk prosjektert basert på et geodetisk koordinatreferansesystem.
- Geodetisk koordinatreferansesystem er basert på en projeksjon.
→ De har en fordreining
- IFC må tilby en klar og utvetydig definisjon for å unngå feiltolkninger.



IfcTunnel – Geometri: Referanselinjer

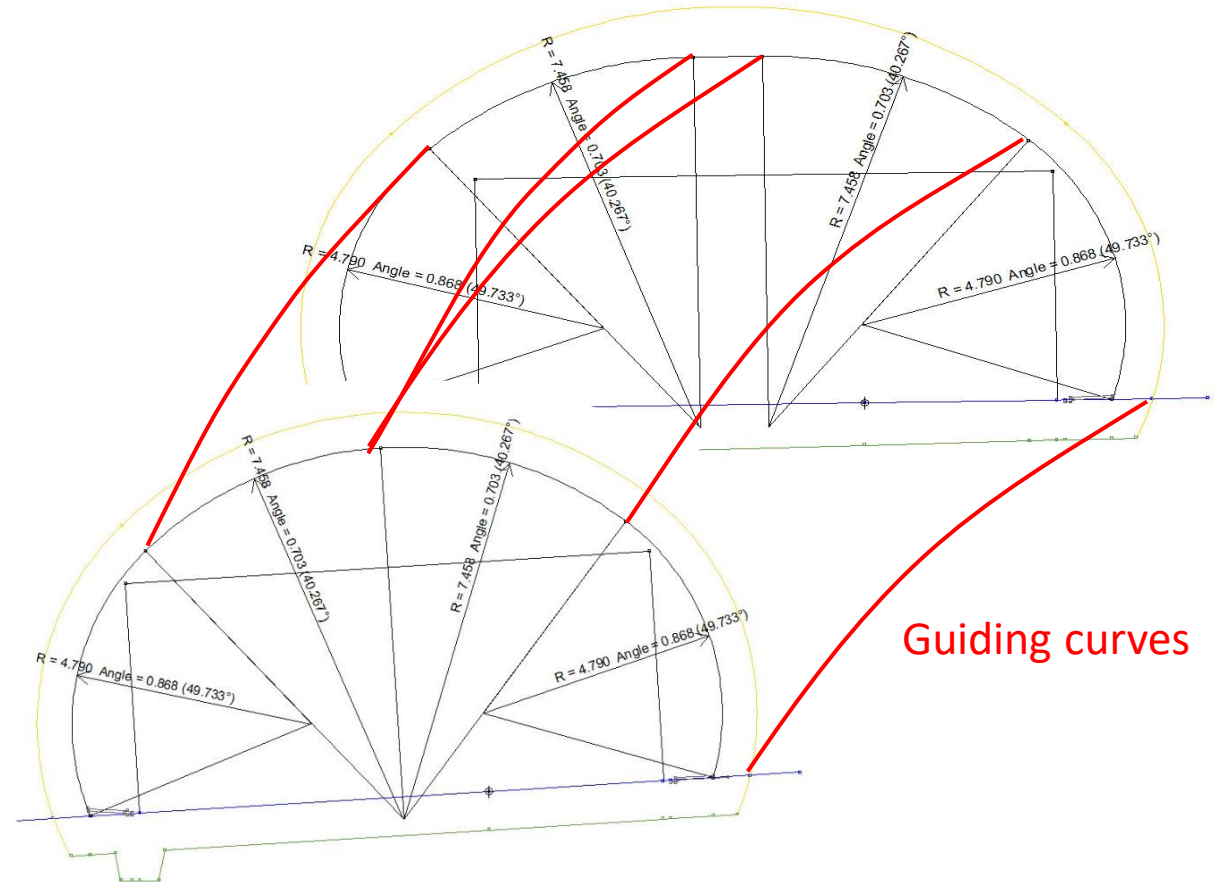
- Referanselinjer er viktige for:
 - Tunnel akse
 - Basis for “swept” geometri
 - Plassering av elementer lang aksen
- Skiller mellom:
 - Referanselinjen for vei/ jernbane
 - Bore aksen (som prosjektert)
 - Tunnel aksen (som bygget)
- IFC 4.3 oppfyller alle kravene:
 - Ikke nødvendig med utvidelser i IFC4.4



IfcTunnel – Geometri: “Guided Sweep”

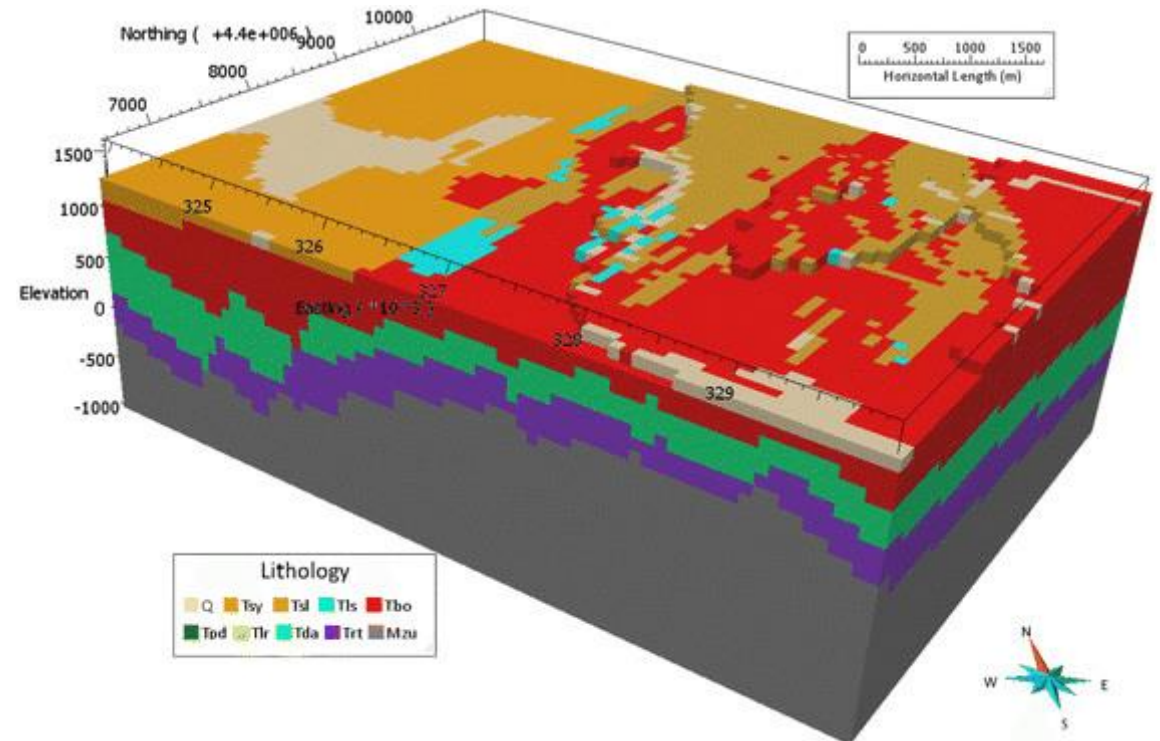
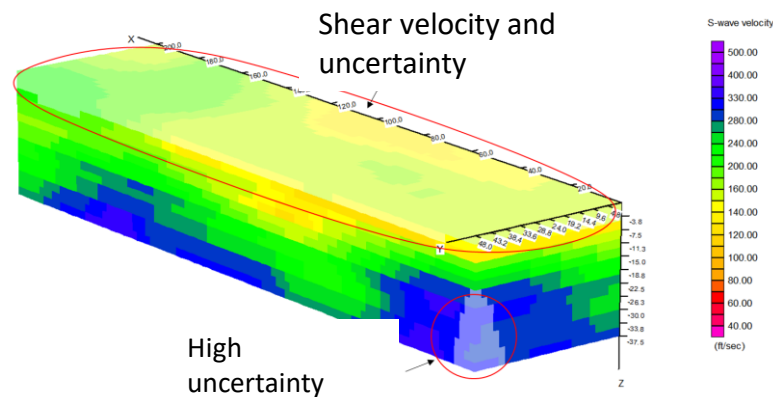
“Guided Sweep”

- Varierende tverrsnitt langs referanselinja.
- Definerer interpolasjonen mellom tverrsnitt med “Guiding Curves”.
- “Guiding Curves” kobler tilhørende punkter i to etterfølgende tverrsnitt.



IfcTunnel – Geometri: Voxel representasjon

- Voxel representasjon støtter romlig variasjon av vareierende grunnforhold **uten å måtte definere spesifikke avgrensninger**.
- Kan benyttes for å modellere usikkerhet og risiko bl.a..



Source: Witter et al. 2016



Ifc-4-T – Uttesting

Programvareløsninger som dekker hele livsløpet:

Prosjekteringsverktøy:

Geoteknikk

Tunnelprosjektering

Systemprosjektering (VA, EI osv)

Maskinstyring og som-bygget registrering

BIM samhandling & IFC valideringsverktøy

Drift og vedlikeholdssystemer

Bibliotek-/komponentleverandører

Konsept forståelse/Implementasjon/Sjekker:

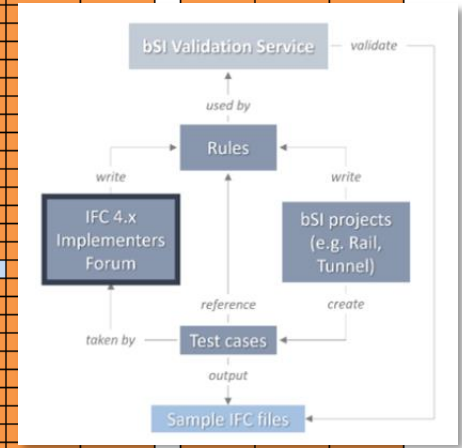
Sprints 1.1 / 1.2 / 1.3 : v

Sprints 2.1 / 2.2 / 2.3 : v

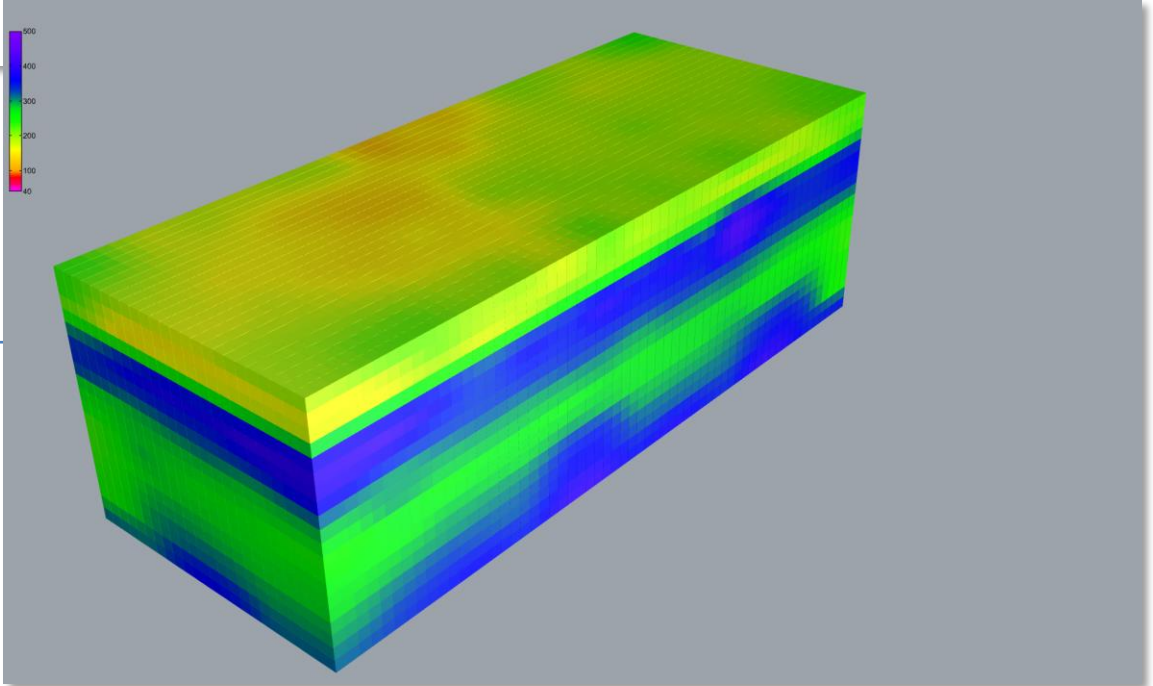
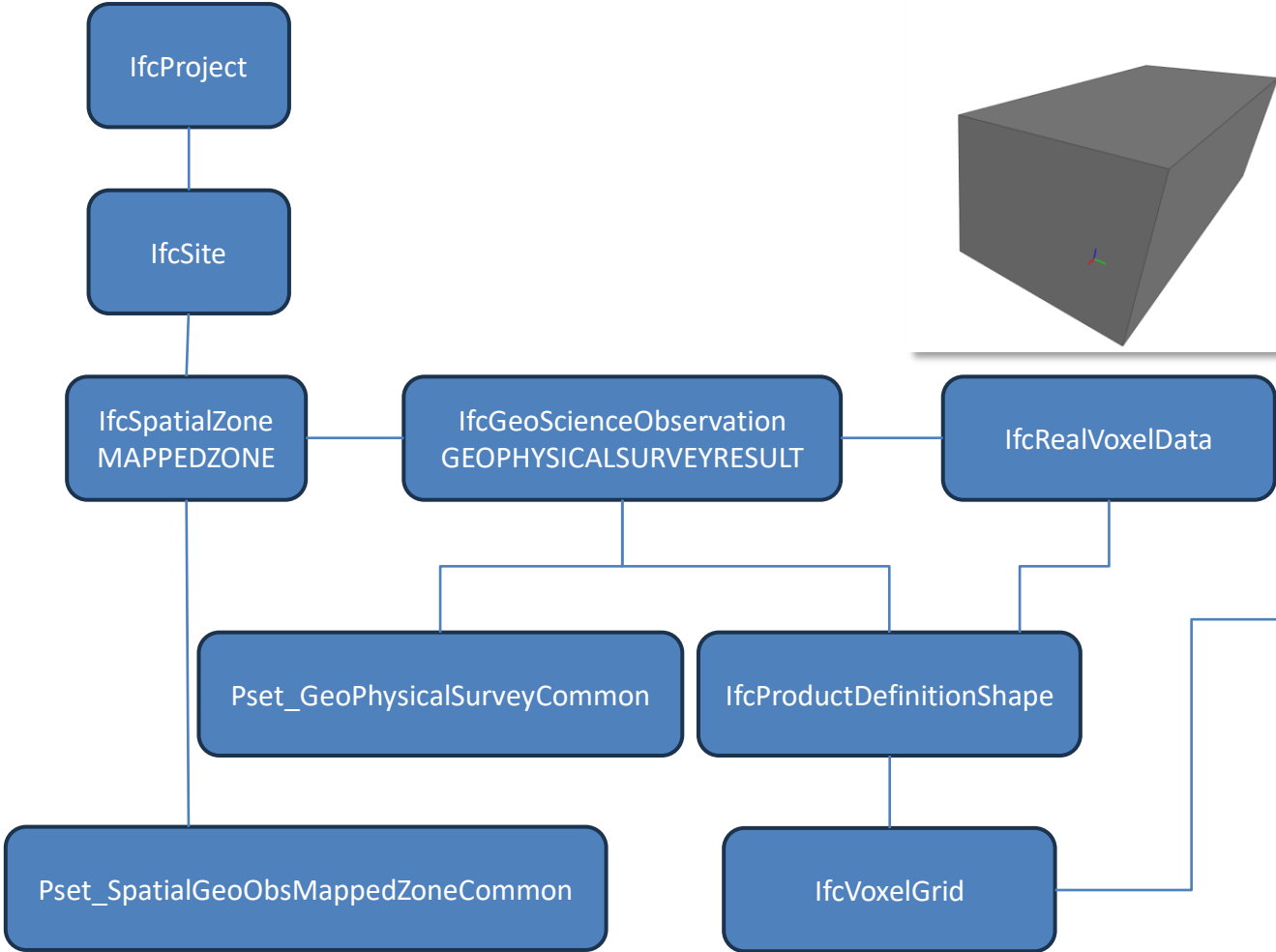
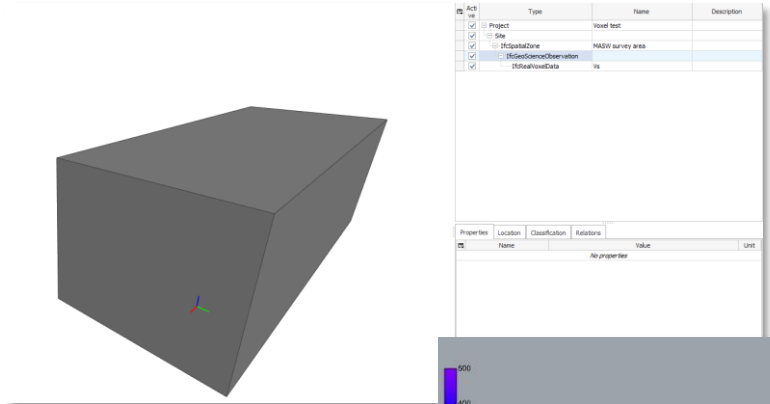
Sprint 3.x : Pågående

Implementasjon beviser at skjemaet er OK

bSI IFC-for-Tunnelling - Deployment prgm															
Cmpy/Product Teams	Domains	Agreem.	KickOff	Fork	R/W	S-1.1	S-1.2	S-1.3	S-2.1	S-2.2	S-2.3	S-3.A	S-3.B	S-3.C	
						Jan 26	Feb 9	Feb 23	Mar 16	Apr 13	Maj 11	June 15	June 15	June 15	
ACCA Software	Excavation-CivilWorks	Signed	Attended	Done	R/W	Passed	Passed	Passed	Passed	Passed	Passed				
ACCA Software	Collaborative platforms	Signed	Attended	Done	R	Passed	Passed	Passed	Passed	Passed	Passed				
Amberg-NO	Excavation-CivilWorks	Signed	Attended	Done	R/W	Passed	Passed	Passed							
Autodesk-C3D	Excavation-CivilWorks		Attended	Done	R/W	Checked									
Autodesk-RVT	Systems for operation		Attended	Done	R/W	Checked									
Autodesk-A360	Collaborative platforms		Attended	Done	R										
Bentley-Civil	Excavation-CivilWorks	Signed	Attended		R/W										
Bentley MEP	Systems for operation														
Bentley-Seequent	Geotechnics	Signed	Attended	Done	R/W	Passed	Checked	Checked							
Bentley-Seequent	Collaborative platforms	Signed	Attended	Done	R	Checked									
BeverControl	Excavation-CivilWorks	Signed	Attended	Done	R/W	Passed	Passed	Passed	Passed	Passed	Passed		Passed	Passed	
Bridge SWI	Excavation-CivilWorks		Attended	Done	R/W	Passed	Passed								
Catenda	Collaborative platforms	Signed	Attended	Done	R	Checked	Checked	Checked							
Dassault Systems	Excavation-CivilWorks	Signed	Attended	Done	R/W	Passed	Passed								
Dassault Systems	Systems for operation	Signed	Attended	Done	R/W	Passed	Passed								
Dassault Systems	Collaborative platforms	Signed	Attended	Done	R	Passed	Passed								
Datacomp	Collaborative platforms		Attended		R										
Deep Excavation	Geotechnics	Signed	Attended	In-Progres	R/W										
Deep Excavation	Excavation-CivilWorks	Signed	Attended	In-Progres	R/W										
Dibit Messtechnik	Excavation-CivilWorks		Attended		R/W										
eCassini	Collaborative platforms		Attended		R										
Epiroc	Excavation-CivilWorks														
ESPI	Geotechnics		Attended	Done	R	Checked	Checked	Checked							
ESPI	Collaborative platforms		Attended	Done	R	Checked	Checked	Checked							
Geoconsult	Geotechnics	Signed	Attended	In-Progres	R										
GeometryGym	Lib/Tkt providers	Signed	Attended	Done	R/W	Passed	Passed								
Geovita	Geotechnics		Attended		R/W										
Herrenknecht	Excavation-CivilWorks		Attended	Done	R/W	Passed	Checked	Checked	Checked						
Igutech	Geotechnics	Signed	Attended	Done	R/W	Passed	Passed	Passed							
Infrakit	Collaborative platforms		Attended		R										
Leica Geosystems	Excavation-CivilWorks														
MapInfo	Geotechnics		Attended		R										
Maxwell Geosystems	Geotechnics		Attended	Done	R/W	Checked									
Maxwell Geosystems	Excavation-CivilWorks		Attended	Done	R/W	Checked									
Maxwell Geosystems	Collaborative platforms		Attended	Done	R	Checked									
Nemetchek-Allplan	Excavation-CivilWorks		Attended	Done	R/W	Passed	Passed								
Nemetchek-MEP	Systems for operation		Attended	Done	R/W										
Nemetchek-Solibri	Collaborative platforms		Attended	Done	R										
ODA	Lib/Tkt providers		Attended	Done	R/W	Passed	Passed	Checked	Checked	Checked	Checked	Checked	Checked	Checked	
ODD corporation	Geotechnics		Attended	Done	R/W	Passed	Passed	Passed	Checked	Checked	Checked	Checked	Checked	Checked	
RDF	Lib/Tkt providers		Attended	Done	R/W	Passed			Checked	Checked	Checked	Checked	Checked	Checked	
Trimble-Geo	Geotechnics	Signed	Attended	Done	R/W	Passed	Passed	Passed	Checked	Checked	Checked	Checked	Checked	Checked	
Trimble-NP	Excavation-CivilWorks	Signed	Attended	Done	R/W	Passed	Passed	Passed	Passed	Passed	Passed	Checked	Checked	Checked	
Trimble-TKL	Excavation-CivilWorks		Attended	Done	R/W	Passed	Passed	Passed	Passed	Passed	Checked		Checked	Checked	
TwelveD	Excavation-CivilWorks		Attended	Done	R/W	Passed	Passed	Passed	Passed	Checked	Checked			Checked	
Vektor.io	Collaborative platforms		Attended		R										
Vizerra	Collaborative platforms		Attended		R										
Volue	Excavation-CivilWorks		Attended	Done	R/W	Passed	Passed	Passed	Checked						



Demo - Voxel data/grid Oyo, Japan



Demo - Oloron - Conversion IFC4.1 => IFC-4-Tunnelling ViaNova France/CETU France

