SLUSSEN

AUTODESK AU 2019 - LONDON

DRAWINGLESS DESIGN AND PRODUCTION IN A €1.2BN INFRASTRUCTURE ALL-IN-BIM PROJECT

Johan Stribeck | VDC-Manager - Design Team | Tikab

SLUSSEN

AUTODESK AU 2019 - LONDON

DELIVERY PLATFORM FOR MODEL BASED DESIGN AND PRODUCTION

Johan Stribeck | VDC-Manager - Design Team | Tikab

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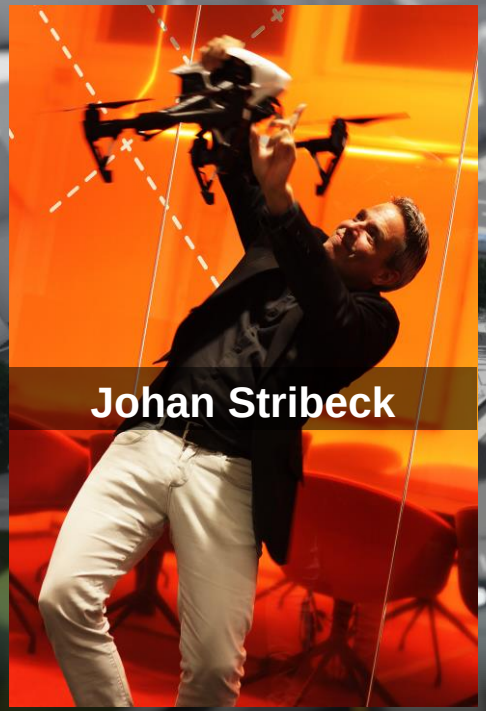
Provide digital strategy and technology services for the built world throughout its lifecycle



Johan Stribeck

Personal Story

-85 Young C64 programmer
-90 Girls & Beer
-95 Structural Engineer
-96 3D Modelling/Animation
-99 CAD/BIM Management
-14 Drone Tech / Reality Capture
-14 Business Area Management in Tikab
-17 Animation → Interactivity →Game Development

Today

- Business Development | Marketing
- Senior Consultant BuildTech Management
- Father of 4
- Exploring Europe with RV

BuildTech Management **Software Development/Interactivity** **Reality Capture**

Stockholms stad

Stockholm Town
Client

SKANSKA

Main Contractor
(Traditional Contract in Cooperation)

ELU

General Consultant
(Consortium Lead)

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BIM Management
Mechanical Design

AGENDA

- Breif historic perspective
- Why rebuild Slussen?
- Clients BIM ambition & requirements
- Initial conditions about BIM implementation
- Our BIM Implementation Strategy
- The framework – Model Based Delivery Platform
- Harvest of low hanging fruits

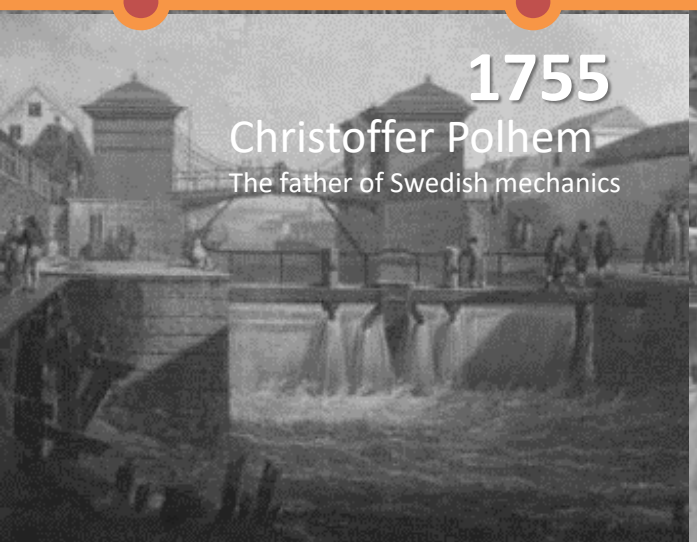
SLUSSEN - YEAR 1570
IMPORTANT TRADE AND TRANSPORT HUB

1642 Queen Kristina

1850 Nils Ericsson
Inventor & Channel Builder

2025

1755
Christoffer Polhem
The father of Swedish mechanics



1935

ELU

Yesterdays Traffic Hub will be replaced by…


….The Meeting
Place - Slussen


DAGENS NYHETER

WHY SHOULD SLUSSEN (THE LOCK) BE REBUILT?

Poor Technical Status

The risk of flooding

The Region and the City are growing

Stockholms stad

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Now
30 yrs
80 yrs
Poor Technical Status

GAMLA STANS SUBWAY STATION YEAR 2000

The risk of flooding

480K

TRAVELLERS/DAY

COMMUNITY FUNCTIONS MUST BE KEPT INTACT DURING CONSTRUCTION TIME

Slussen
Client ambition with BIM/VDC

Increased collaboration

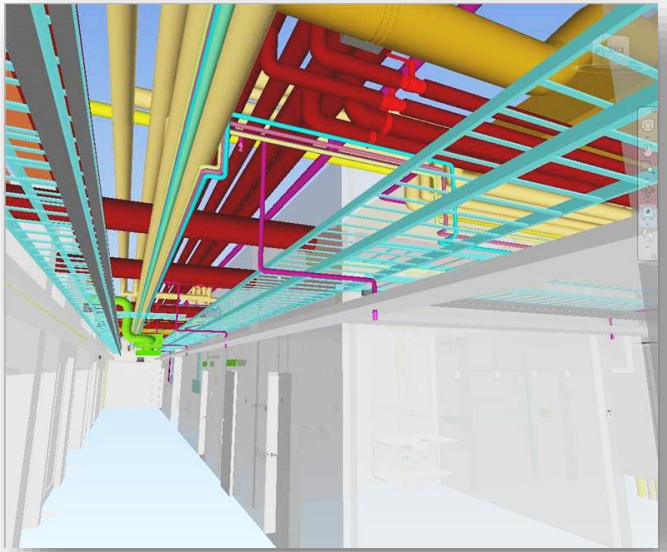
Increased knowledge

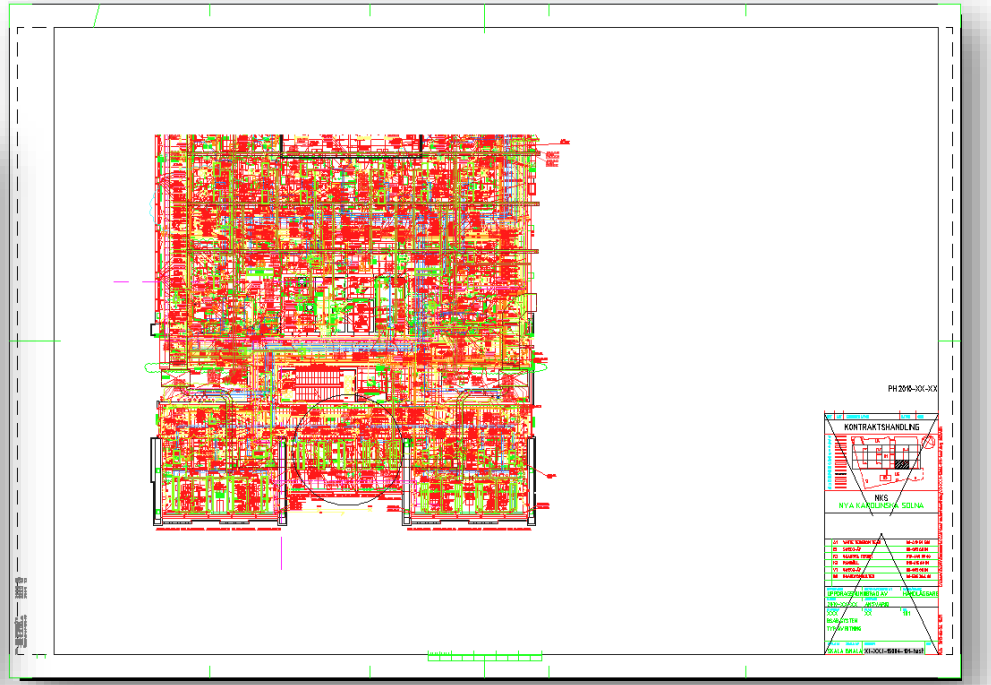
Better Information structure

Stockholms stad

Slussen
Client ambition with BIM/VDC

- Increased understanding
- Better structure of information

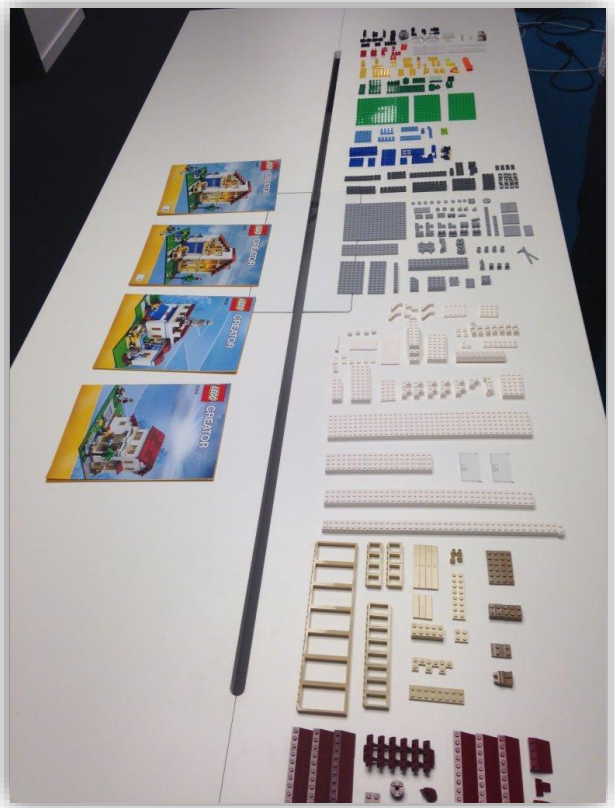




Stockholms stad

Slussen
Client ambition with BIM/VDC

- Increased understanding
- Better structure of information

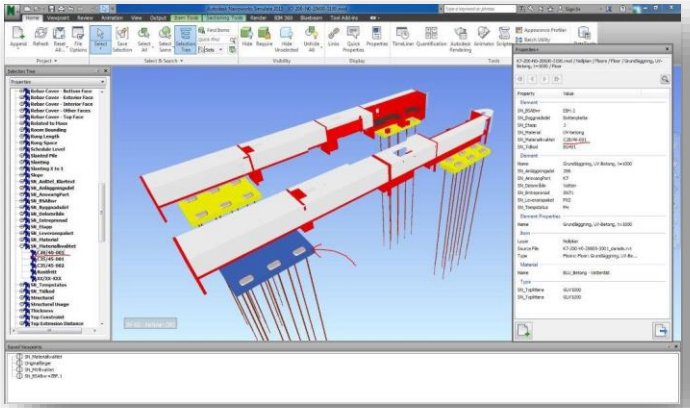


Stockholms stad

Slussen
Client ambition with BIM/VDC

Possibilities

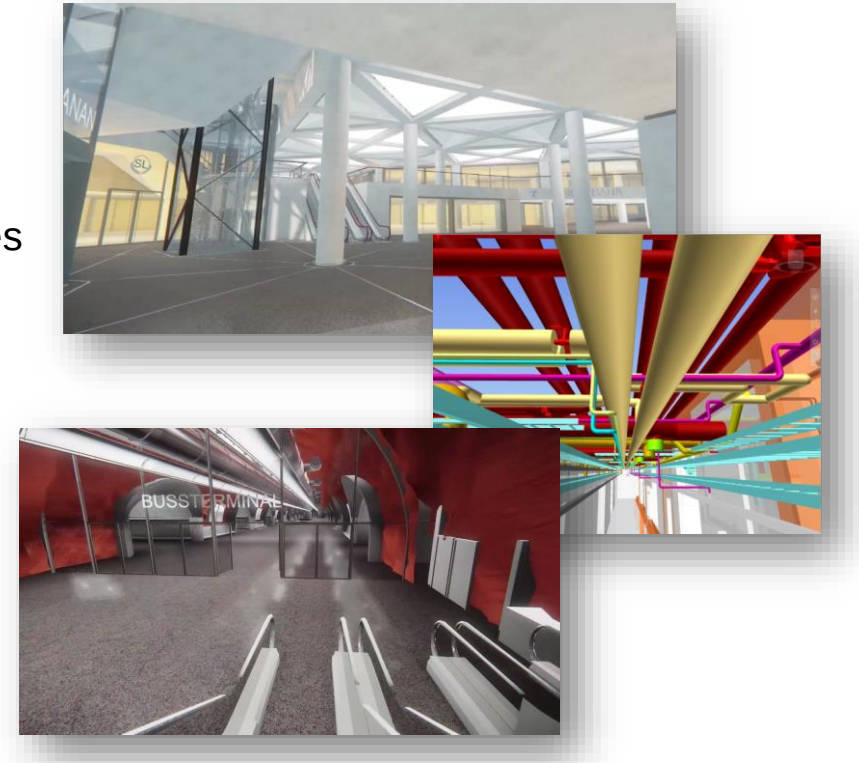
- Focus on the right things in design; modelling and model information, not traditional drawing techniques
- Clog "gaps" between design and production
- Structured and clear delivery to FM



Stockholms stad

Slussen
Clients performance requirements for BIM/VDC

- Coordination & Visualization in 3D
- Review the design in 3D
- Reinforcement i 3D
- Procurements with 3D models/Quantities
- Simulate construction schedule, 4D
- Calculate cost, 5D
- Production Customization
- Handover to FM
- Future applications – future proof



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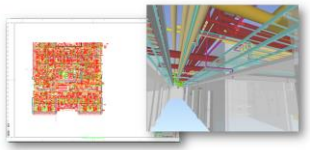
SLUSSEN

Manage to implement the Clients rough VDC-Strategy – HOW?

Varför BIM/VDC?

- Ökad förståelse
- Bättre struktur på informationen



Stockholms stad

2017-05-07
Sida 3

Varför BIM/VDC?

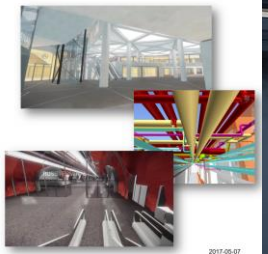
- Ökad förståelse
- Bättre struktur på informationen

Stockholms stad

2017-05-07
Sida 4

Fokusområden

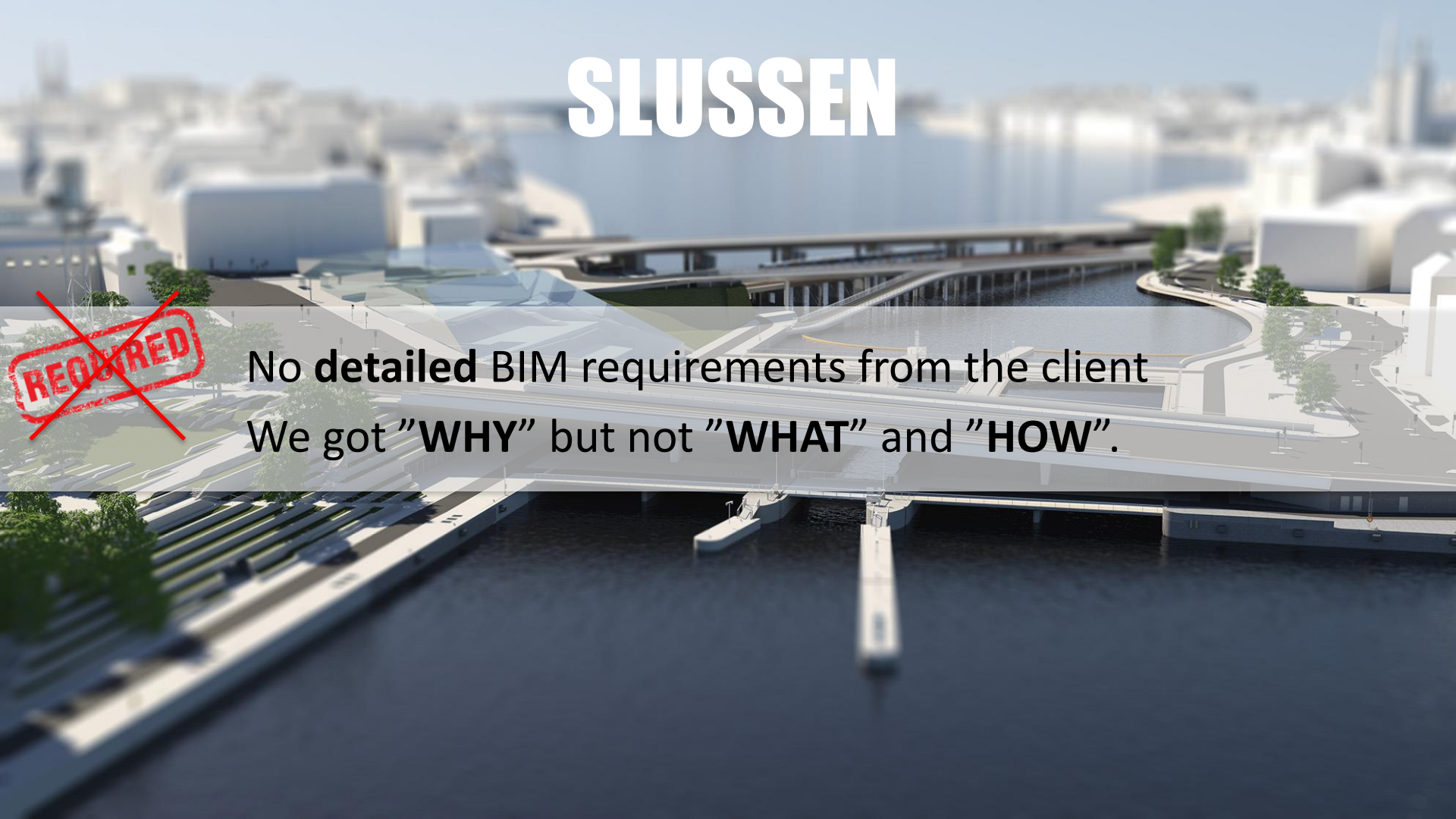
- Samordning & visualisering
- Granskning
- Armering i 3D
- Upphandlingar
- Simulering tidplan, 4D
- Kalkyl, 5D
- Produktionsanpassning
- Förvaltning
- Framtida tillämpningar



Stockholms stad

2017-05-07
Sida 6

SLUSSEN



No **detailed** BIM requirements from the client

We got ”**WHY**” but not ”**WHAT**” and ”**HOW**”.

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Contractor was not contracted to conceal ideas

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No National standards regarding BIM deliveries

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After Swedish Election 2014 – New politics stopped the project for 6 months to review the budget.

At restart - final delivery date remained unchanged

→ **Detailed Design / Production - simultaneously**

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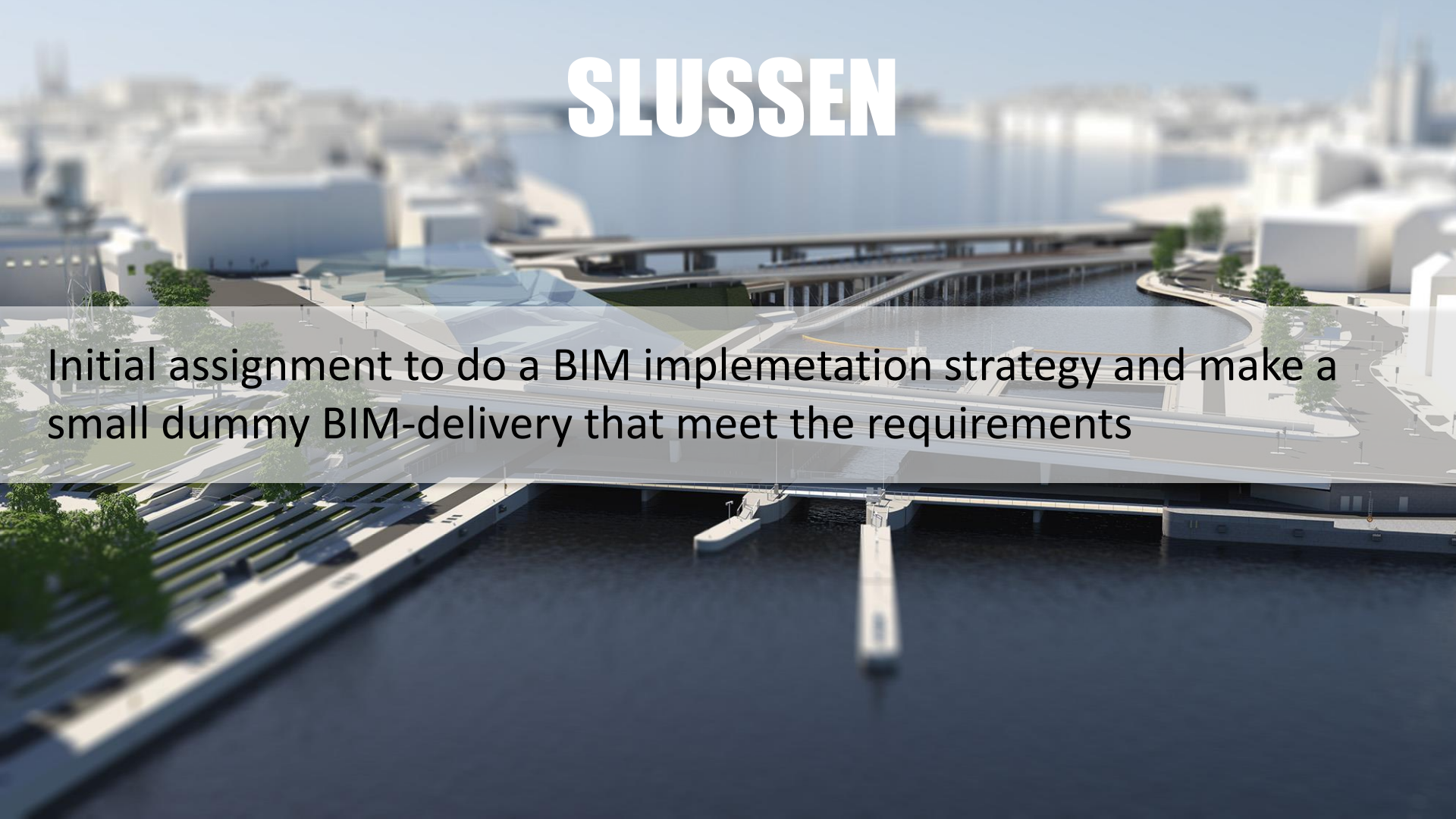
Over 5000 small rapid deliveries planned instead of a few large

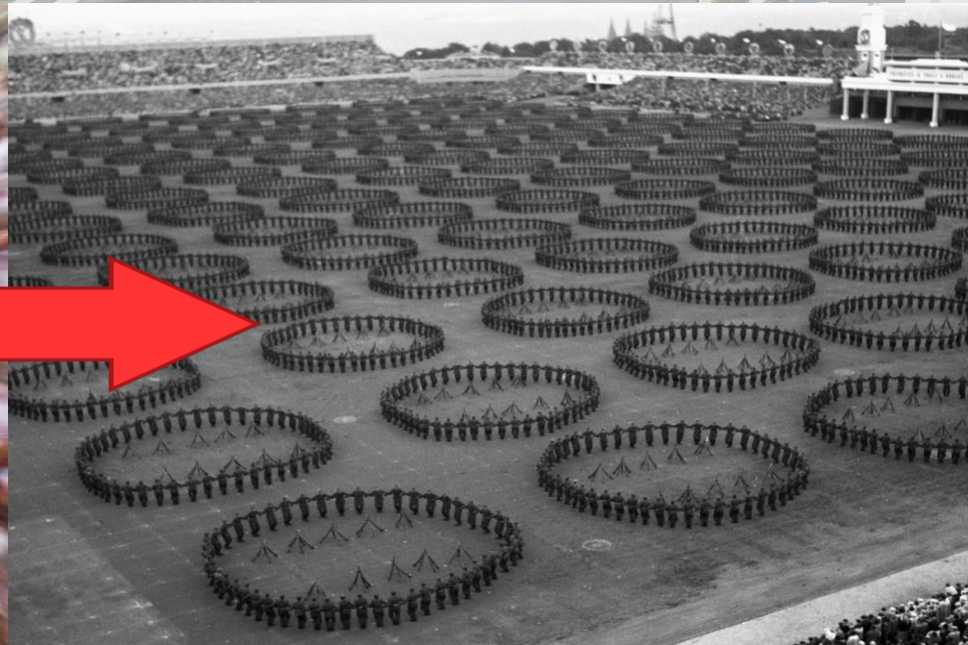


Initial assignment to do a BIM implemetation strategy and make a small dummy BIM-delivery that meet the requirements

SLUSSEN

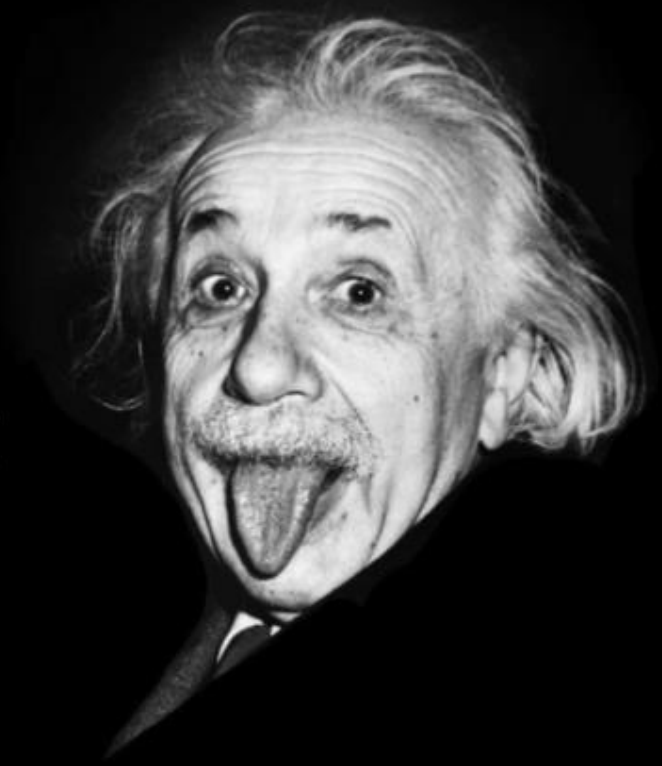
? How do you get a big team to prioritize 3D model and BIM data in an EXTREME project like Slussen?

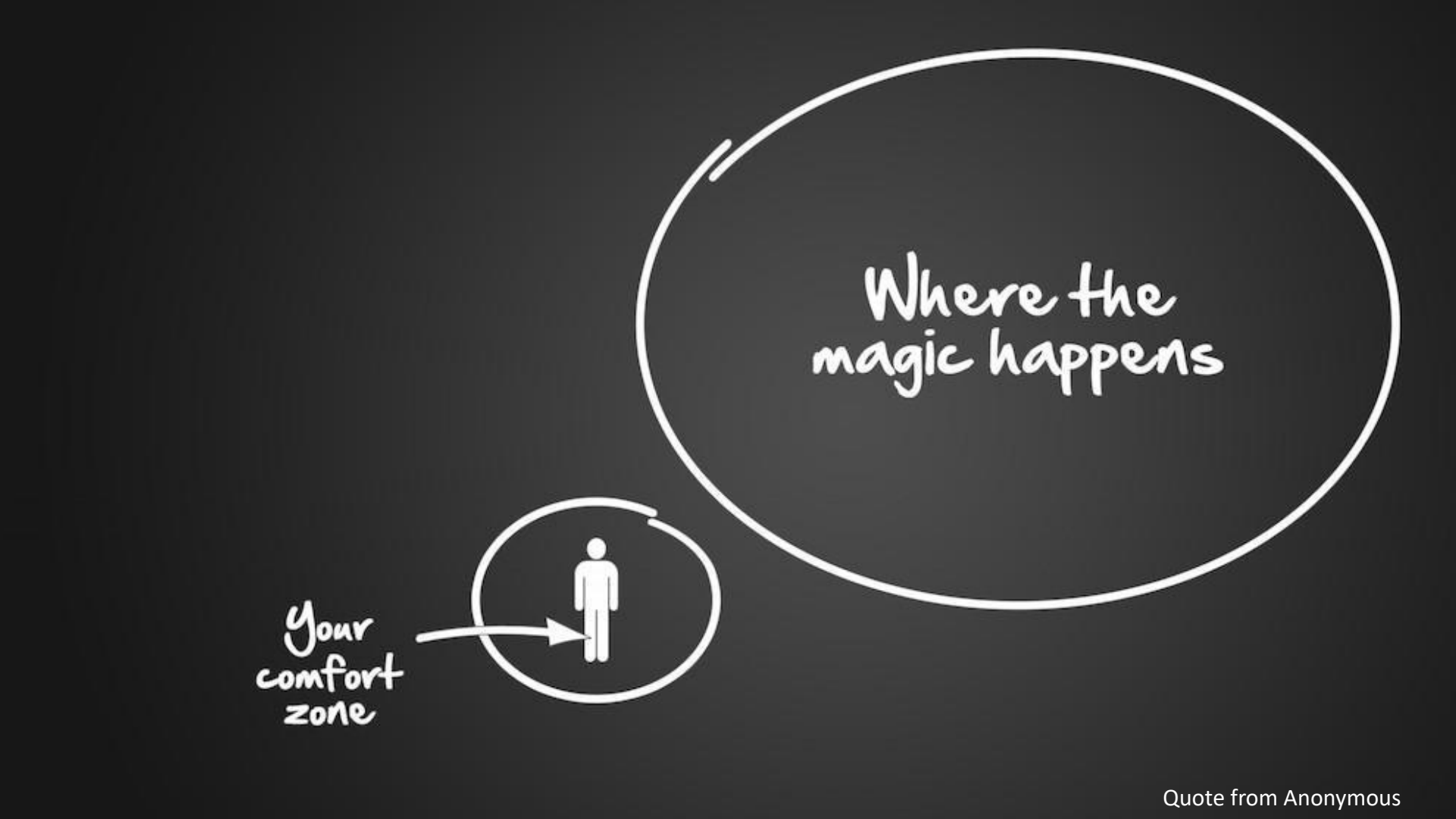
100s of people involved in over 5000 deliveries of construction documents



"Insanity is doing the same thing over and over again and expecting different results"

Albert Einstein





Quote from Anonymous

SLUSSEN

Zero tolerance on traditional drawings!

Why not drawings? They are so common and good?

- Time-consuming to make, change and manage
- In a BIM-project - Information added to drawings **only** exists on drawings.

Reaction: If we do not deliver drawings - What should we deliver then?
→ Easier to implement BIM if the drawings are removed
→ Everyone understands what BIM is all about faster

SLUSSEN

Message: Design and produce the entire project without drawings

- Detailed Design started 2014
- Production started 2016
- Trial delivery from 12 disciplines completed 3 years ago
- Layout has been tweaked with the client and contractor since

Production now running for

- Excavation
- Sheet piling
- Piles
- Concrete foundation and reinforcement

So far no traditional drawings have been delivered!


Digitaliseringen av byggbranschen

Slussen byggs utan ritningar

Headline in Press:
Slussen is being built without drawings

MODEL BASED DELIVERY PLATFORM

TD

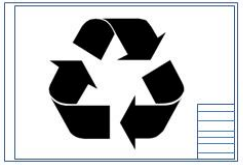
Technical Documentation/Description

BQ

Bills of Quantities

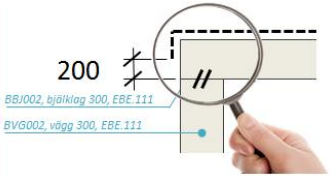
AD

Asset Databases



SS

Standard Solution Drawings

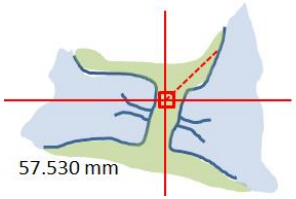


MV

Model View

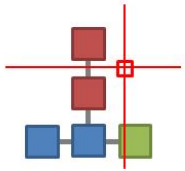
IM

Information Model (BIM)



SM

Stakeout Model (Georeferenced CAD)



CM

Schematic Model (CAD, Symbolic)

4M

4D Sequencing Model

AM

Aggregated Model (Coordination)

10 DIFFERENT WAYS TO DELIVER INFORMATION

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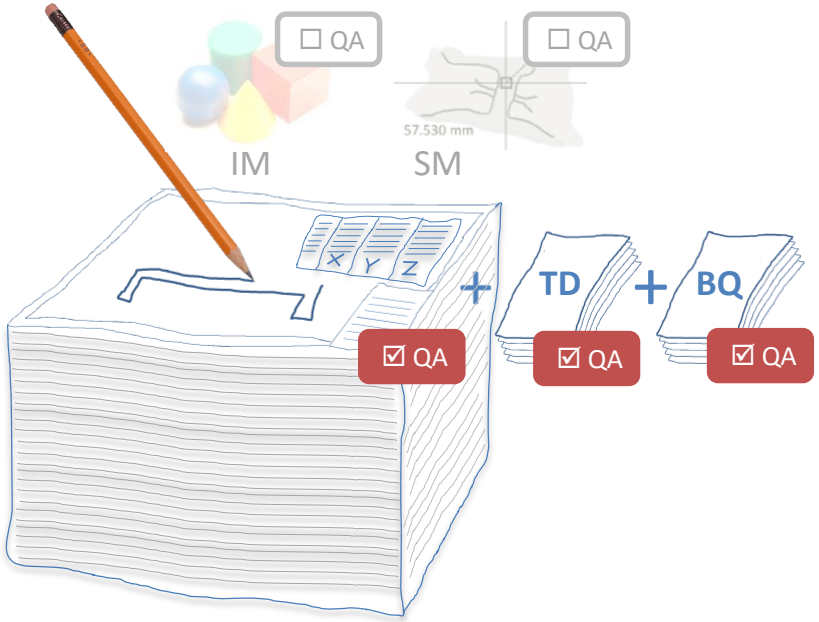
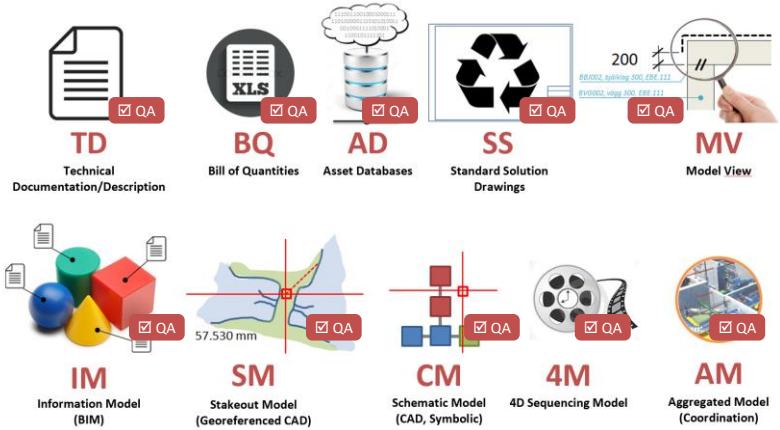
TRADITIONAL VS MODEL BASED DELIVERY

INFORMATION CARRIERS IN TRADITIONAL DELIVERY

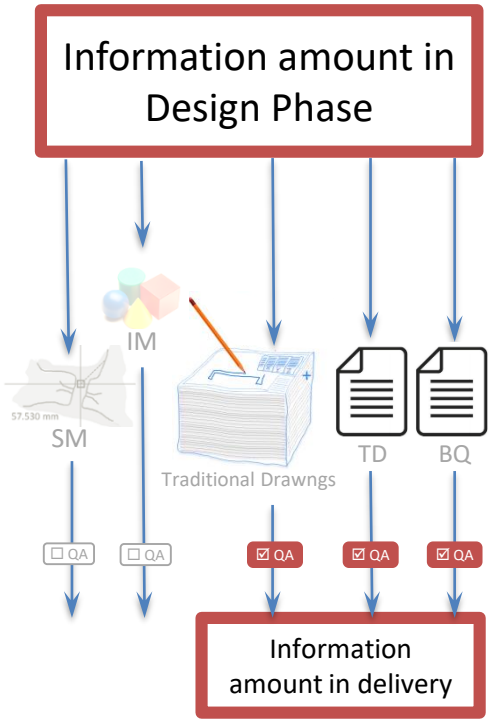


INFORMATION CARRIERS IN MODEL BASED DELIVERY

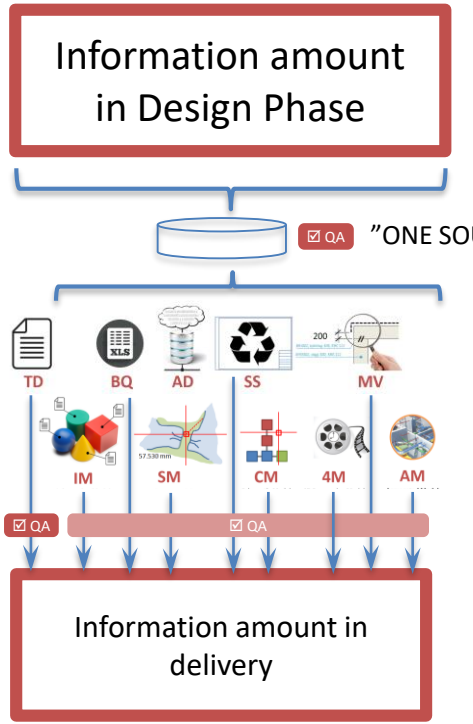


INFORMATION FLOW

TRADITIONAL DRAWING DELIVERY



MODEL BASEED DELIVERY



INFORMATION -CARRIERS

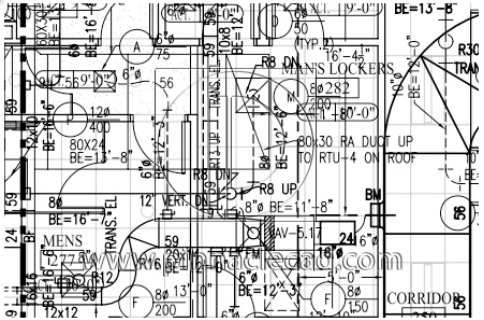
INFORMATION -CARRIERS

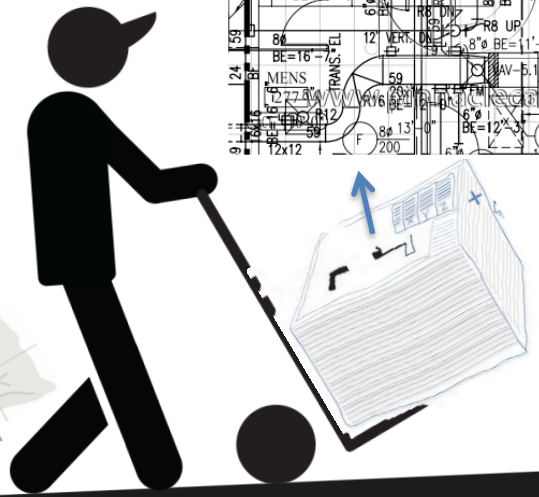
DRAWING DELIVERY

Racks

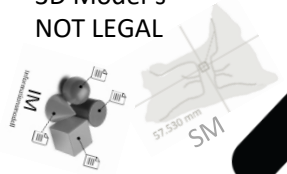
Interpretation

Binders





3D Model´s
NOT LEGAL



MODEL BASED DELIVERY

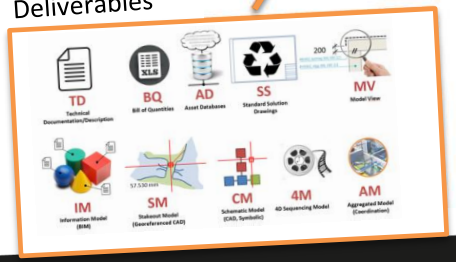
Machine Guidance

CNC-manufacturing

Stakeout

Understanding

Deliverables



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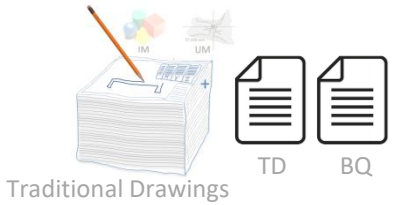
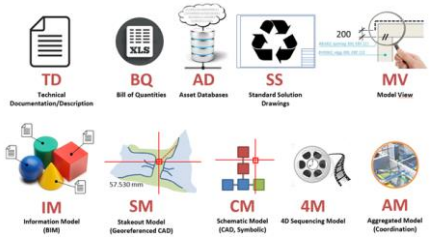
NEW MINDSET

TRADITIONAL DELIVERY

MODEL BASED DELIVERY

INFORMATION-CARRIERS





INFORMATION-CARRIERS

LEGAL DOCUMENTS

TEXT & LINES ON PAPER/FILM

DIGITAL MODELS

LEGAL DOCUMENTS

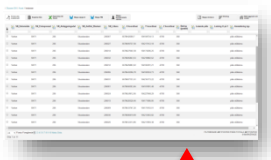
HANDLED AT YOUR OWN RISK

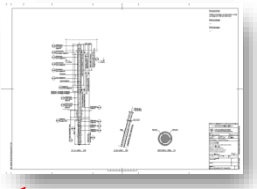
DIGITAL MODELS

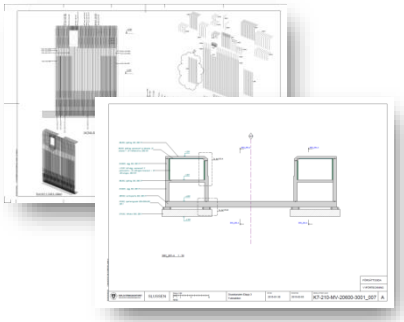
PRINTED PAPER DOCUMENTS

HANDLED AT YOUR OWN RISK

INFORMATION CARRIERS OF THE PLATFORM







TD
Technical Documentation/Description

BQ
Bill of Quantities

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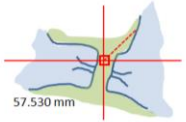
Asset Databases

SS
Standard Solution Drawings

MV
Model View

IM
Information Model (BIM)



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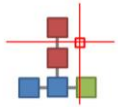

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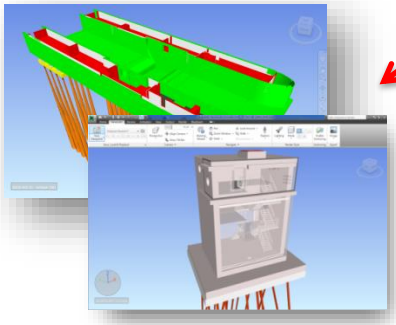

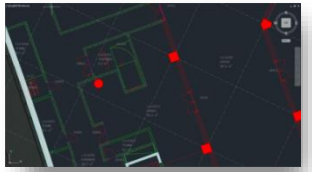

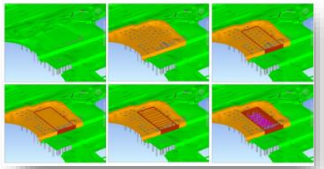

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MODEL BASED DELIVERY PLATFORM

10 OPTIONS OF DELIVERING DIGITAL INFORMATION

TD

Technical Documentation/Description

BQ

Bills of Quantities

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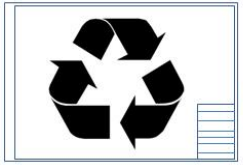
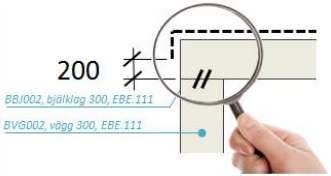
Asset Databases



SS

Standard Solution Drawings

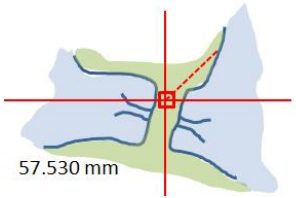


MV

Model View

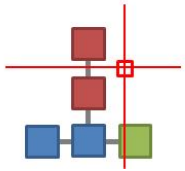
IM

Information Model (BIM)



SM

Stakeout Model (Georeferenced CAD)



CM

Schematic Model (CAD, Symbolic)

4M

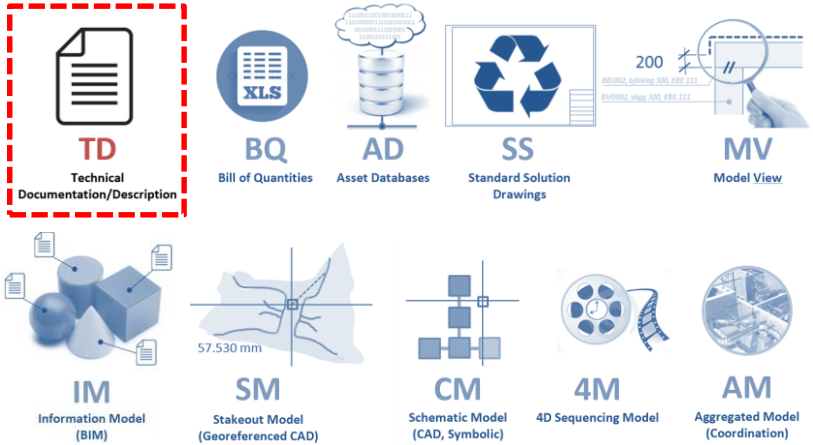
4D Sequencing Model

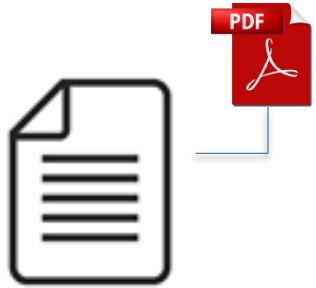
AM

Aggregated Model (Coordination)

INFORMATION CARRIER - TD

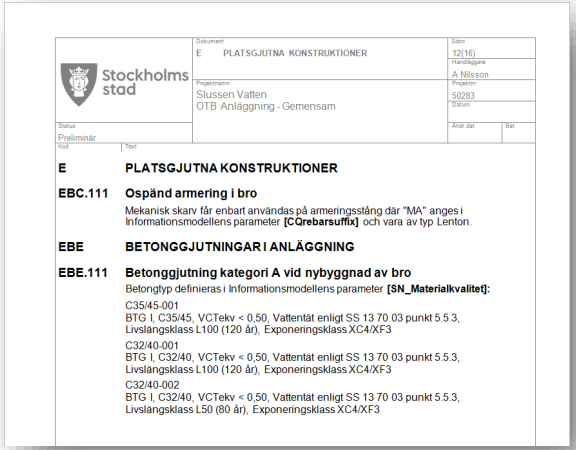
TECHNICAL DOCUMENTATION/DESCRIPTION





TD

Technical Documentation/Description



Stockholms stad

Dokument: E PLATSGJUTNA KONSTRUKTIONER

Sidnr: 12(16)

Handläggare: A Nilsson

Projektnamn: Slussen Vatten OTB Anläggning - Gemensam

Projektnr: 50283

Datum:

Status: Preliminär

Ändr.dat | Bet

Kod	Text
E	**PLATSGJUTNA KONSTRUKTIONER**
EBC.111	**Ospänd armering i bro**
	Mekanisk skarv får enbart användas på armeringsstång där "MA" anges i Informationsmodellens parameter **[CQrebarsuffix]** och vara av typ Lenton.
EBE	**BETONGGJUTNINGAR I ANLÄGGNING**
EBE.111	**Betonggjutning kategori A vid nybyggnad av bro**
	Betongtyp definieras i Informationsmodellens parameter **[SN_Materialkvalitet]:**
	C35/45-001 BTG I, C35/45, VCTekv < 0,50, Vattentät enligt SS 13 70 03 punkt 5.5.3, Livslängsklass L100 (120 år), Exponeringsklass XC4/XF3
	C32/40-001 BTG I, C32/40, VCTekv < 0,50, Vattentät enligt SS 13 70 03 punkt 5.5.3, Livslängsklass L100 (120 år), Exponeringsklass XC4/XF3
	C32/40-002 BTG I, C32/40, VCTekv < 0,50, Vattentät enligt SS 13 70 03 punkt 5.5.3, Livslängsklass L50 (80 år), Exponeringsklass XC4/XF3

PALETTE WITH 10 INFORMATION CARRIERS

ICON

EXAMPLE

TD/IM-CONNECTION

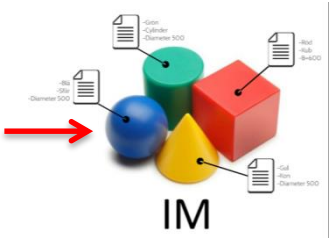
TECHNICAL DESCRIPTION/INFORMATION MODEL

Stockholms stad

Dokument	Sidnr
E PLATSGJUTNA KONSTRUKTIONER	12(16)
	Handläggare: A Nilsson
Projektnamn: Slussen Vatten, OTB Anläggning - Gemensam	Projektnr: 50283
	Datum
Status: Preliminär	Ändr.dat / Bet

Kod	Text
E	**PLATSGJUTNA KONSTRUKTIONER**
EBC.111	**Ospänd armering i bro**
	Mekanisk skarv får enbart användas på armeringsstång där "MA" anges i Informationsmodellens parameter **[CQrebarsuffix]** och vara av typ Lenton.
EBE	**BETONGGJUTNINGAR I ANLÄGGNING**
EBE.111	**Betonggjutning kategori A vid nybyggnad av bro**
	Betongtyp definieras i Informationsmodellens parameter **[SN_Materialkvalitet]**:
→	C35/45-001 BTG I, C35/45, VCTekv < 0,50, Vattentät enligt SS 13 70 03 punkt 5.5.3, Livslängsklass L100 (120 år), Exponeringsklass XC4/XF3
→	C32/40-001 BTG I, C32/40, VCTekv < 0,50, Vattentät enligt SS 13 70 03 punkt 5.5.3, Livslängsklass L100 (120 år), Exponeringsklass XC4/XF3
→	C32/40-002 BTG I, C32/40, VCTekv < 0,50, Vattentät enligt SS 13 70 03 punkt 5.5.3, Livslängsklass L50 (80 år), Exponeringsklass XC4/XF3

Reference to parameters and values in IM →



IM

Examples of receipts for concrete

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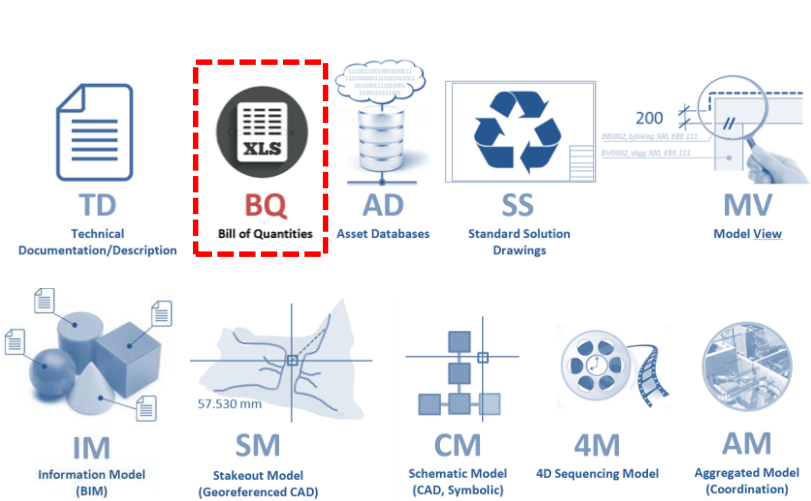
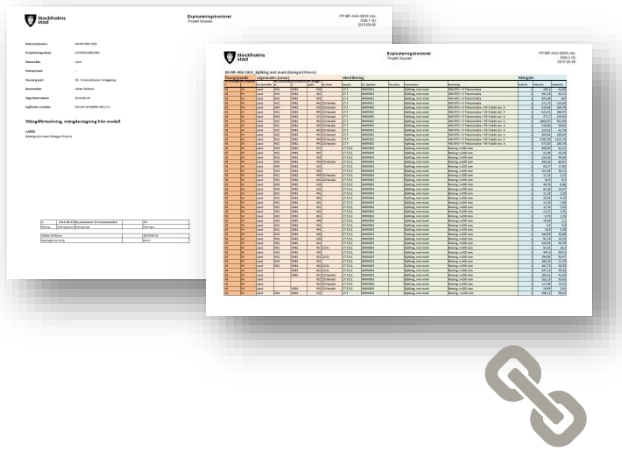
INFORMATION CARRIER - BQ

BILLS OF QUANTITIES





PALETTE WITH 10 INFORMATION CARRIERS

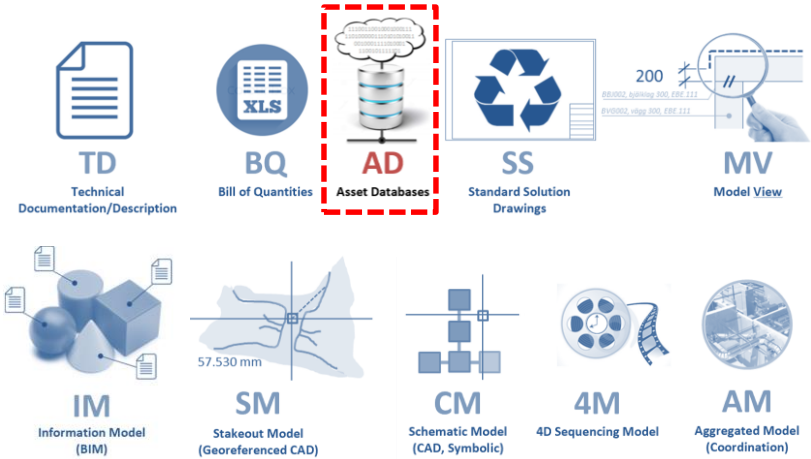
- Quantities from models
- Manually estimated quantities for objects thats not modelled
- Deliveries for use with calculation softwares

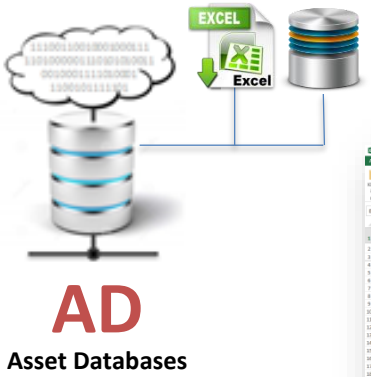
ICON

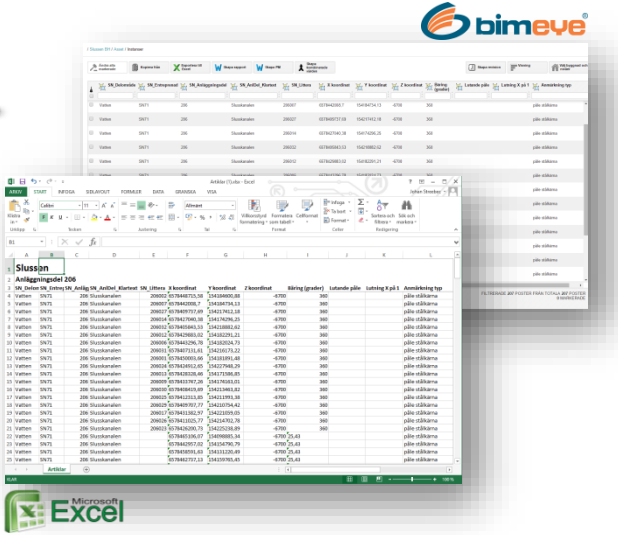
EXAMPLE

INFORMATION CARRIER - AD

ASSET DATABASES







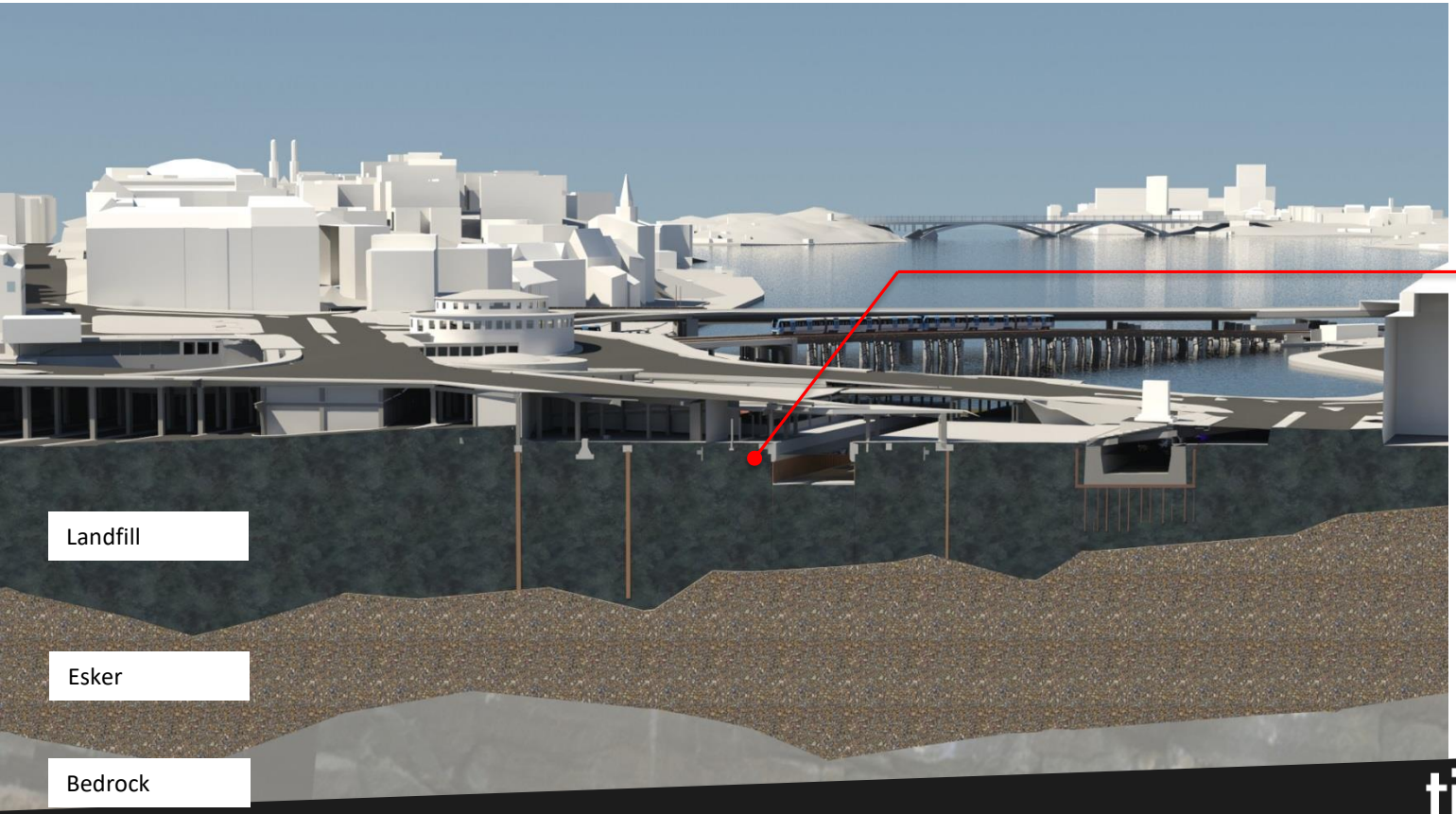
PALETTE WITH 10 INFORMATION CARRIERS

ICON

EXAMPLE

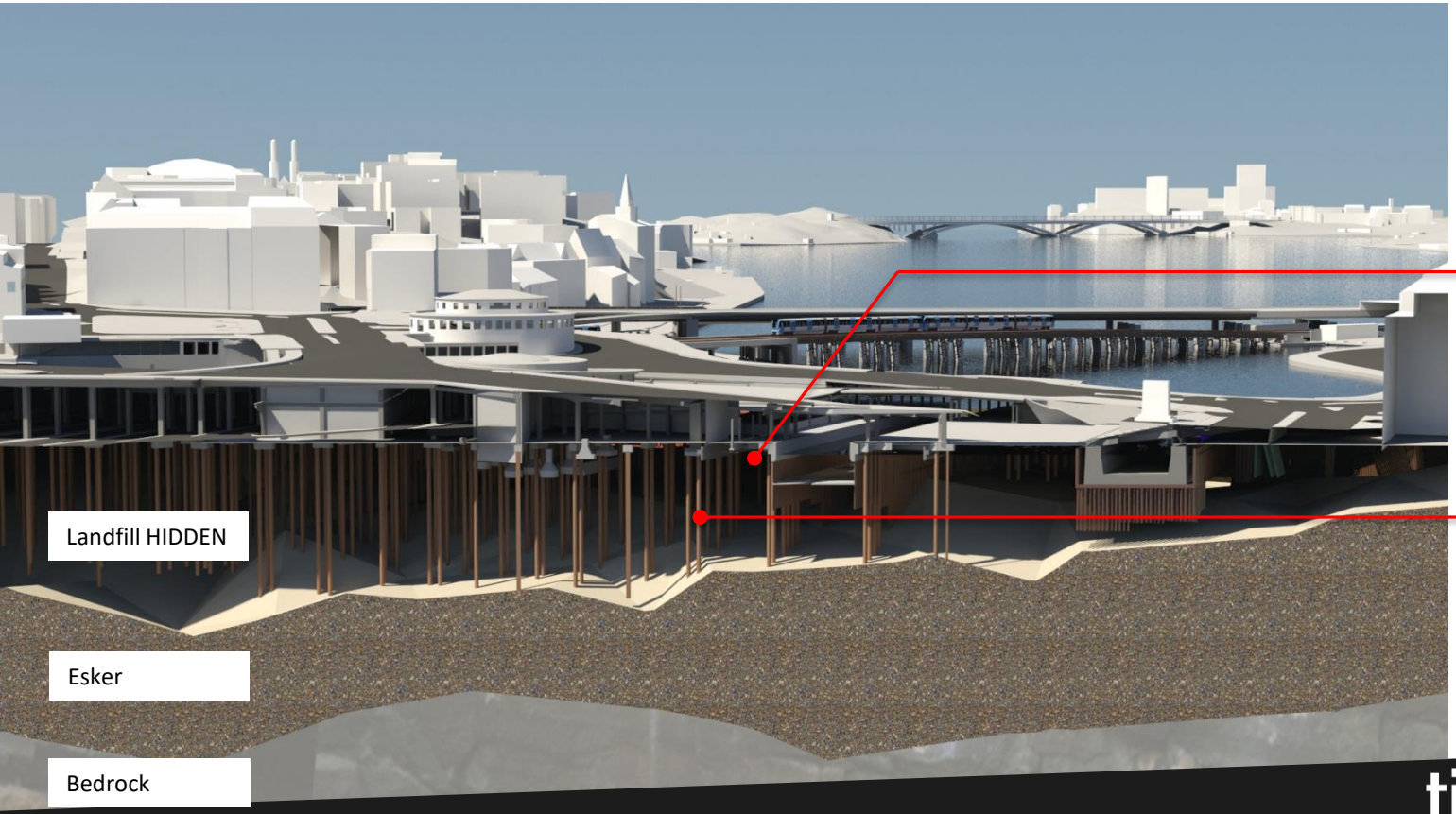
EXAMPLE-AD

ASSET DATABASES



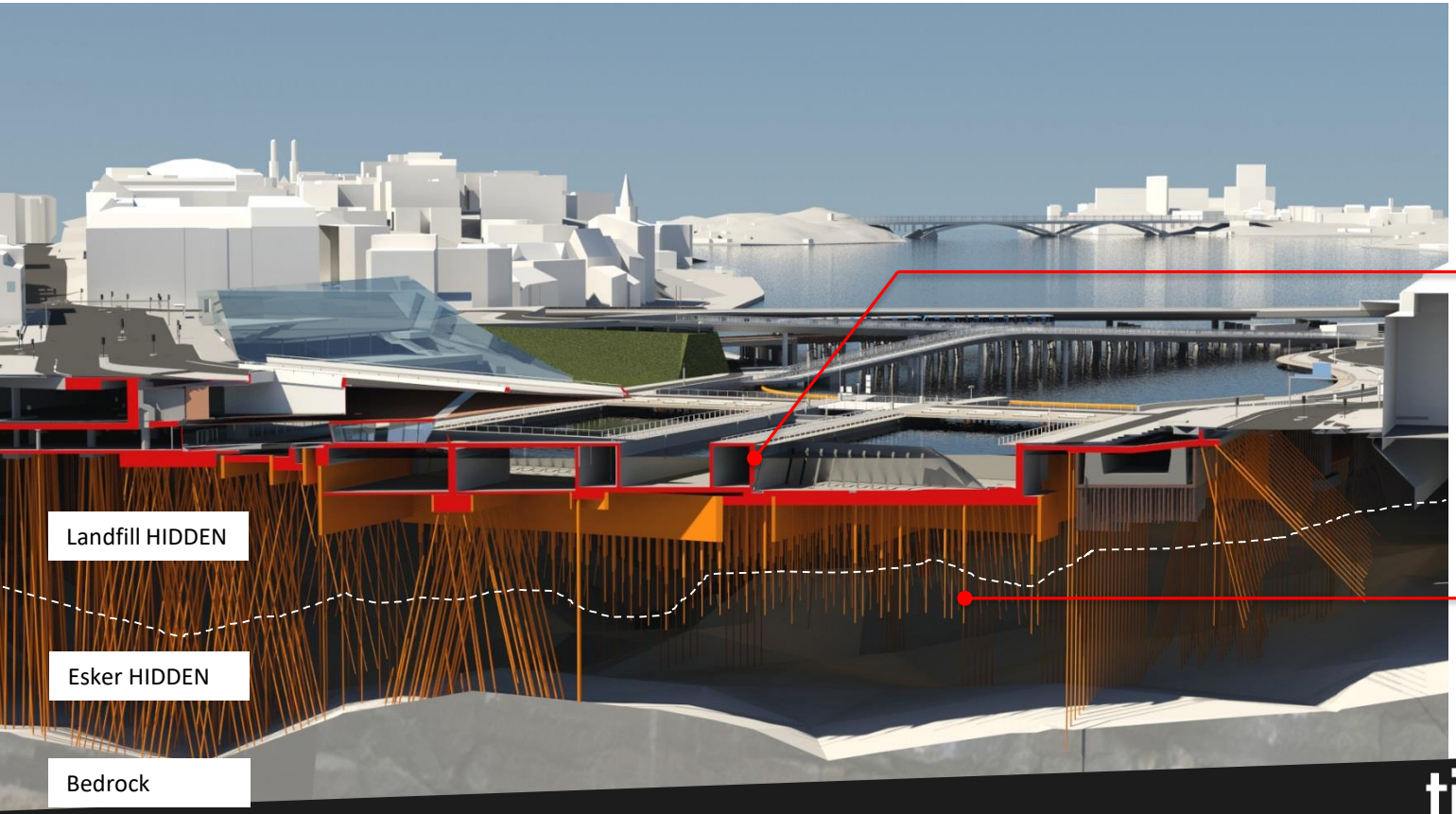
EXAMPLE-AD

ASSET DATABASES



EXAMPLE-AD

ASSET DATABASES



Section through new facility

New foundation
-3200 piles (ca 70m deep)
-sheet piling

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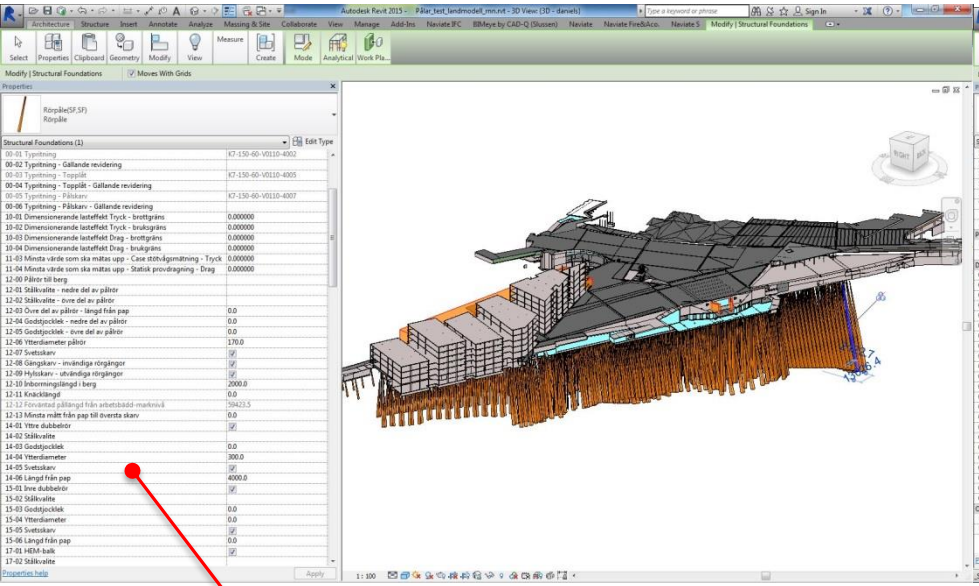
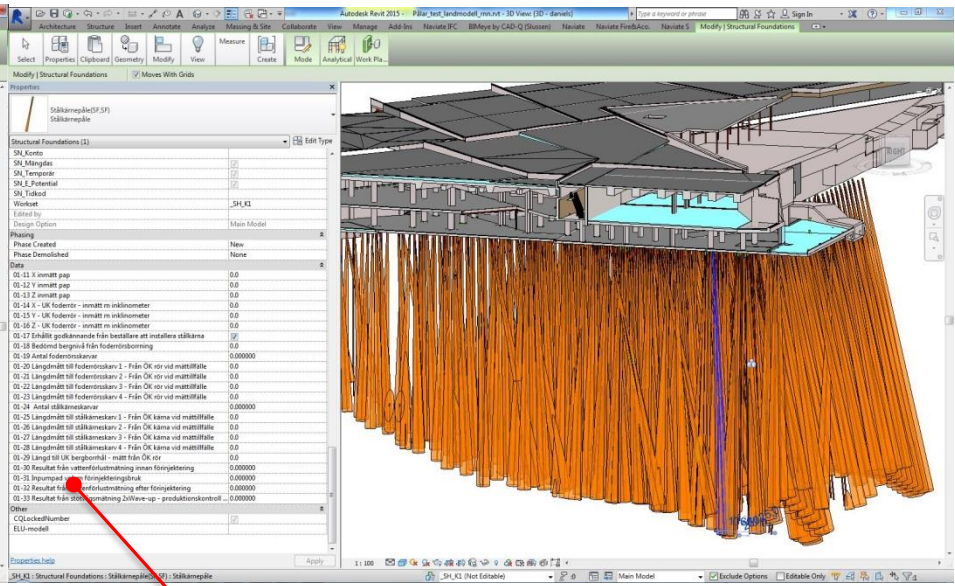
EXAMPLE-AD

ASSET DATABASES

Piling



Approximately 80 different properties from design to production



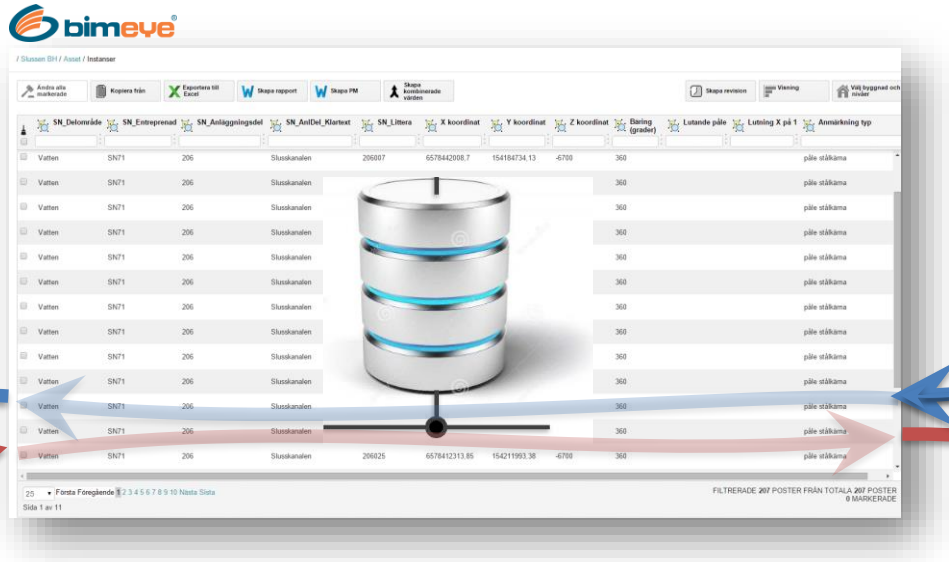
Approximately 30 different properties from production back to design

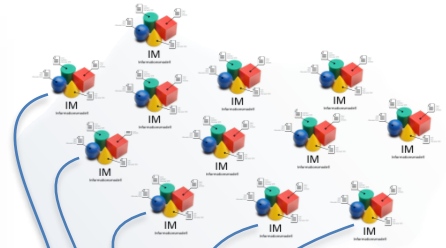
EXAMPLE-AD (BIMEYE)

Contractor

Delivery of piling data via Asset Database

Design Team

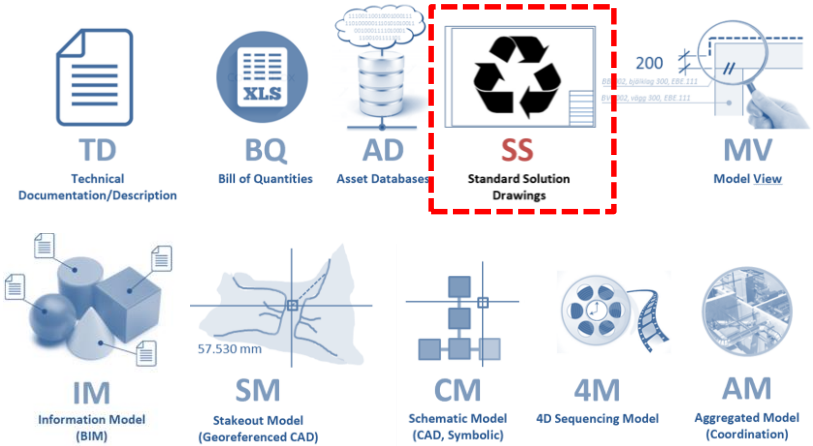


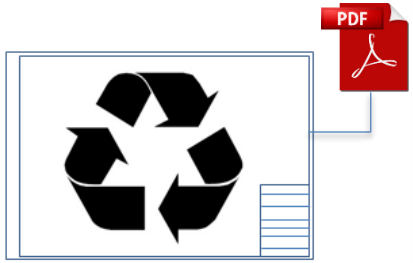


AS BULT INFORMATION

INFORMATION CARRIER - SS

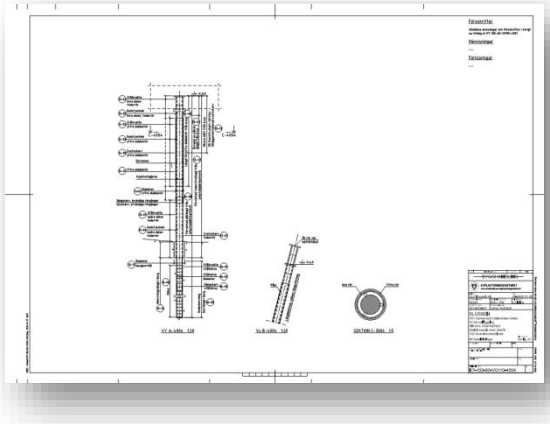
STANDARD SOLUTION DRAWING





SS

Standard Solution Drawings



PALETTE WITH 10 INFORMATION CARRIERS

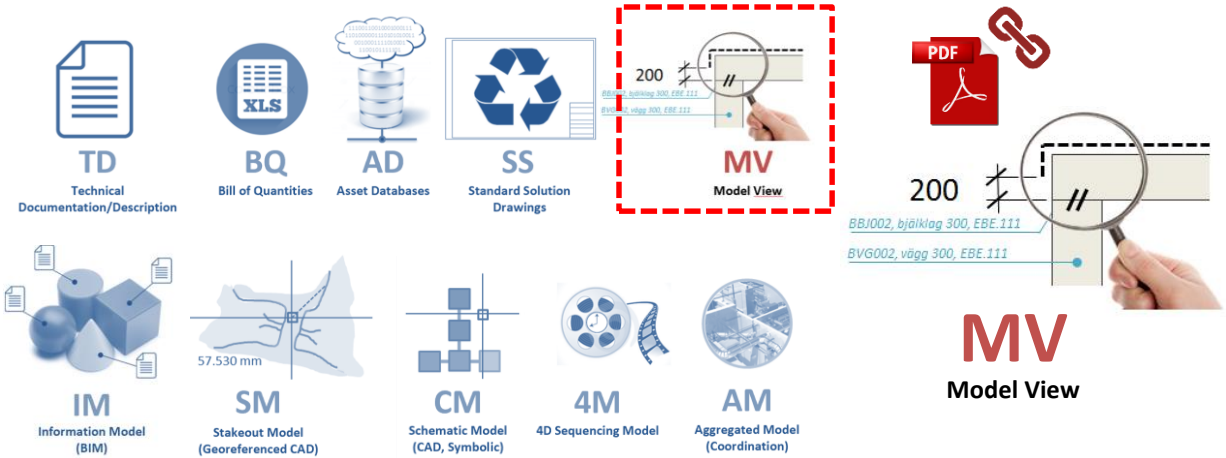
-SS are not showing measurements
-No geographical information
-Standard solutions that can be referenced from models
-Shows where the parameters in the dB are valid

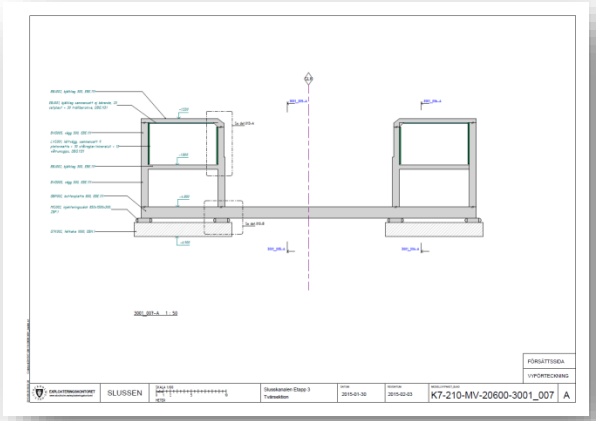
ICON

EXAMPLE

INFORMATION CARRIER - MV

MODEL VIEW





PALETTE WITH 10 INFORMATION CARRIERS

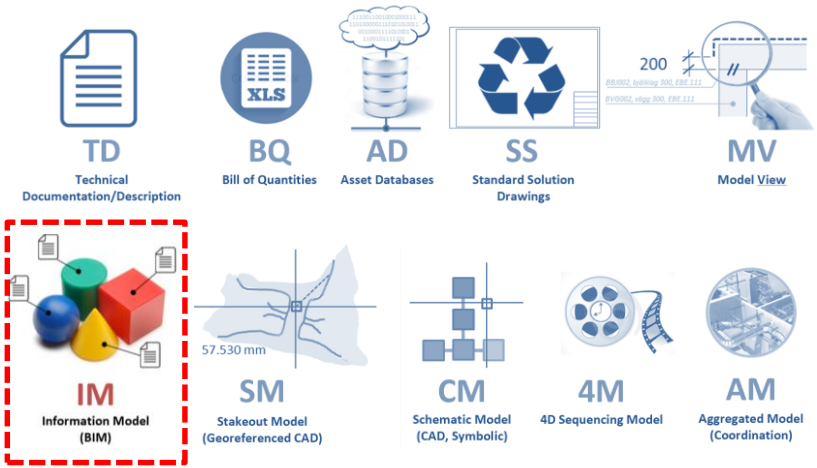
ICON

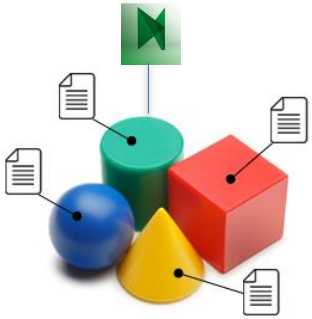
EXAMPLE

- No measurements (Will be found in SM)
- Several views in each PDF package. Hyperlinked for digital use
- Will show things that are not modelled. Exampe: Symbols for casting joints. This is BLACK information in model view
- BLUE information is BIM Data thats tagged out from BIM object. We serve with this information when a model view is made. We DO NOT have as many model views as we should have if we made tratidional drawings. Only a few

INFORMATION CARRIER - IM

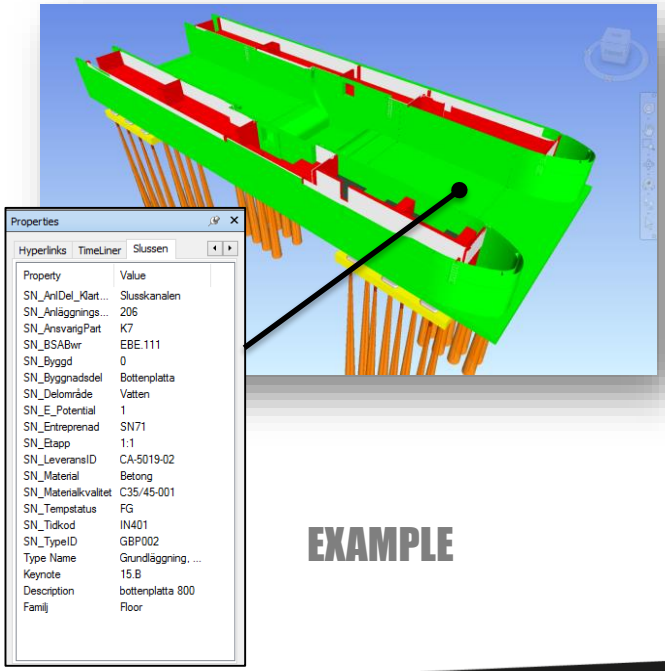
INFORMATION MODEL (BIM)





IM

Information Model (BIM)

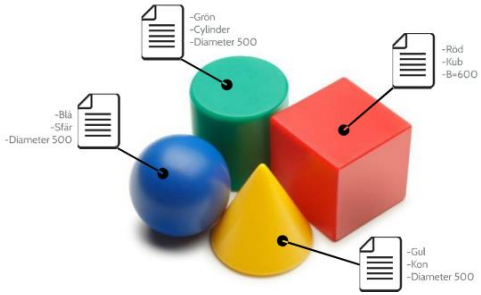


PALETTE WITH 10 INFORMATION CARRIERS

- Information carrier for the ”I” in BIM
- Marking, descriptions, geographical information, contract number, delivery ID etc
- One or more IM in each delivery as a bit of pussle. We have 1000s of deliveries.

ICON

EXAMPLE



EXAMPLE-IM

INFORMATION MODEL

Viewer

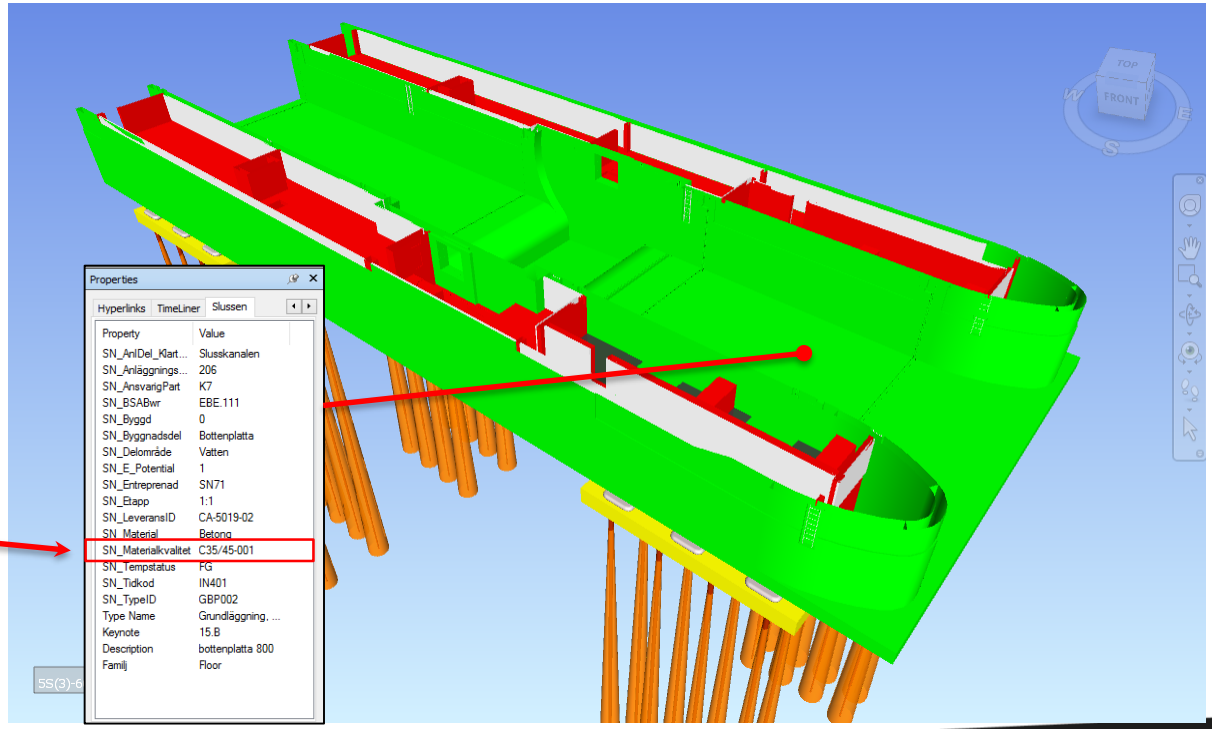
- Geometry carries selected BIM information
- Ex Material Quality
- Linking to Detailed Receipt In TD
- Delivered models are puzzled by the receivers.

[SN_Materialquality]

C35/45-001

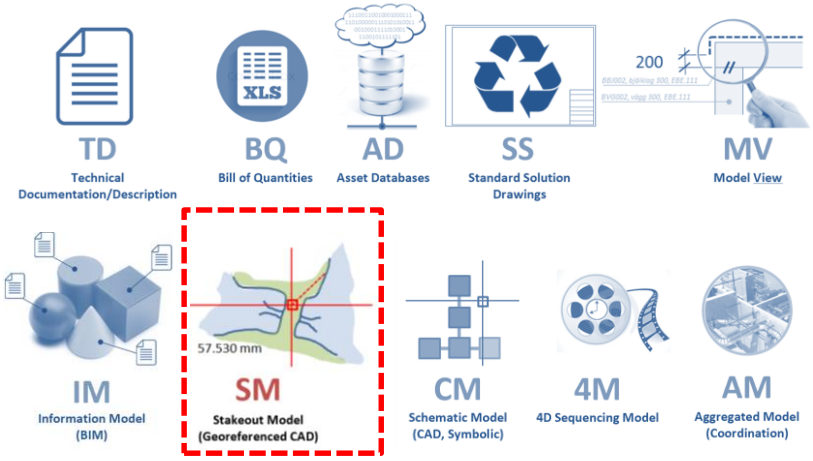
C32/40-001

C32/40-002

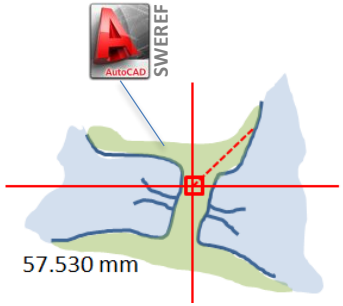


INFORMATION CARRIER - SM

STAKEOUT MODEL



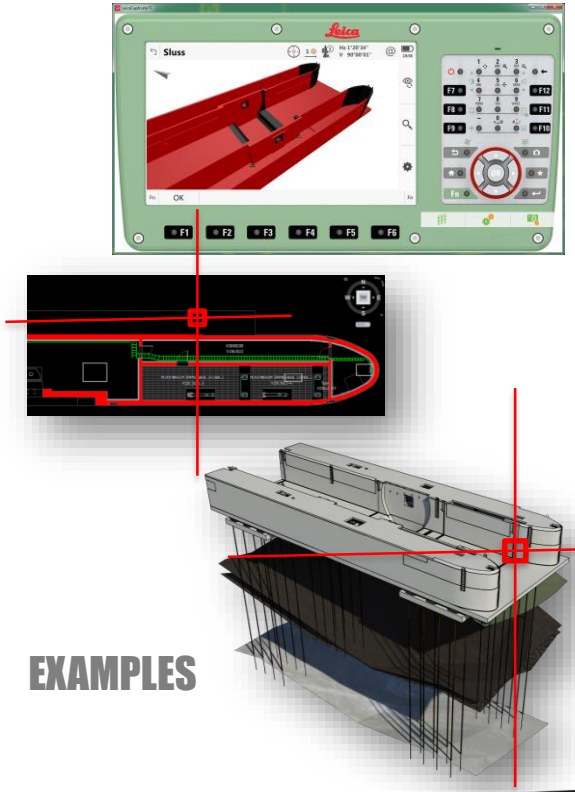
PALETTE WITH 10 INFORMATION CARRIERS



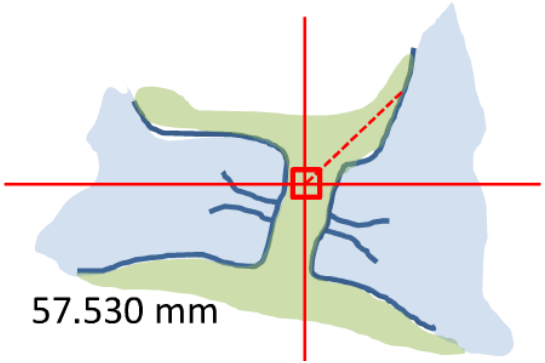
SM

Stakeout Model
(Georeferenced 2D/3D-CAD)

ICON



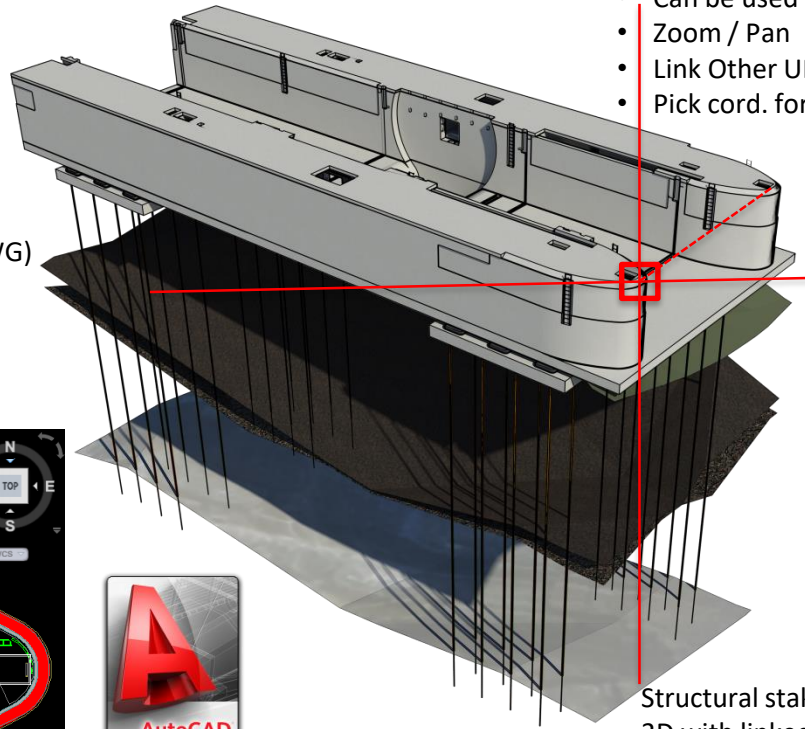
EXAMPLES



EXAMPLE-SM

STAKEOUT MODEL

- 3D model, DWG
- Can be used in computer/ipad
- Zoom / Pan
- Link Other UM (2D / 3D)
- Pick cord. for surveying

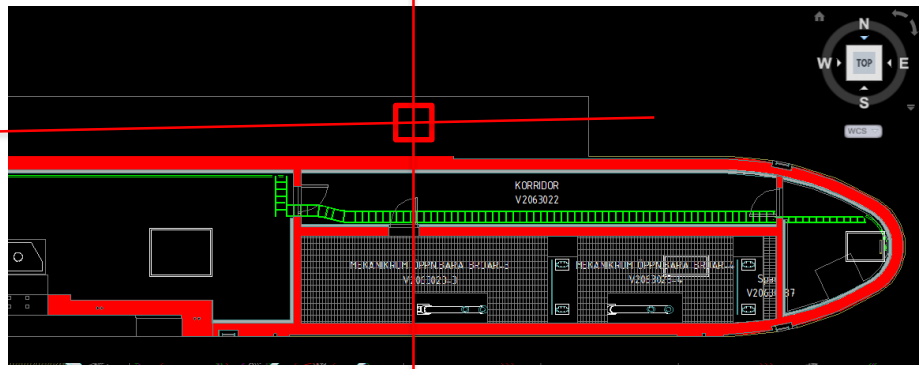


Measured Length:
15000 mm

Coordinate:
X=6578 407.121 m
Y=154 224.195 m
Z=1.530 m

Structural stakeout model in 3D with linked models of Rock layers

- A large digital "drawing" (2D DWG)
- Can be used in computer / ipad
- Zoom / Pan
- Link Other SM (2D / 3D)
- Print (at your own risk)



2D Stakeout model

AutoCAD

Viewer

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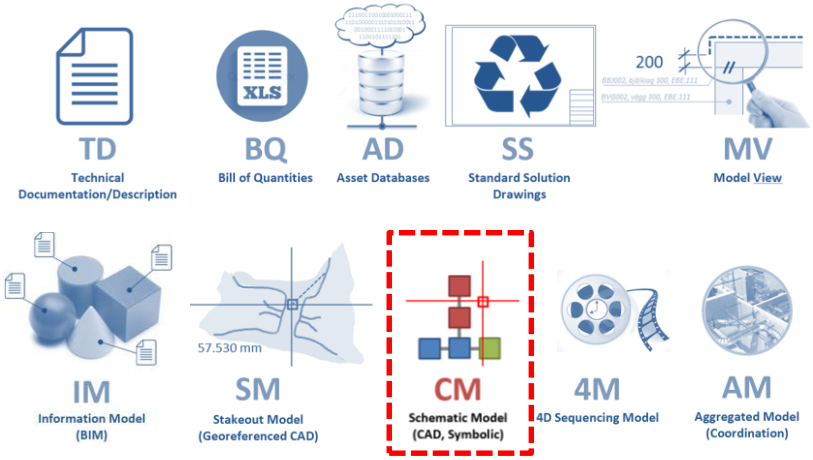
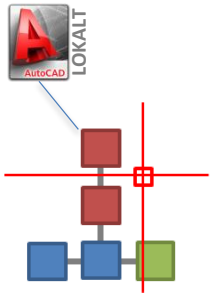
INFORMATION CARRIER - CM

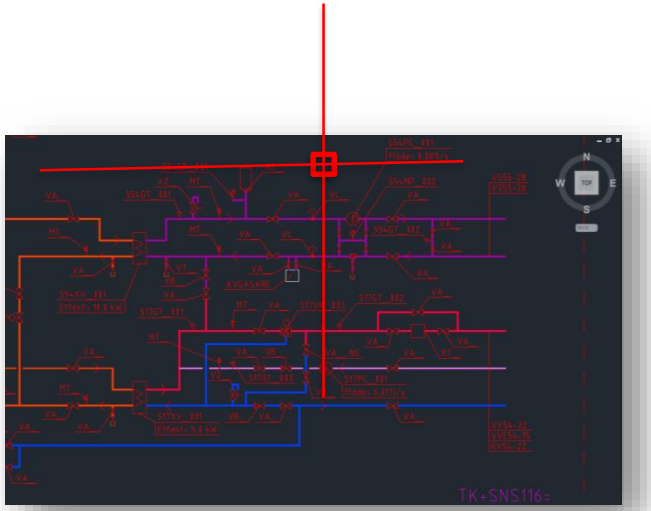
SCHEMATIC MODEL (2D-CAD)



PALETTE WITH 10 INFORMATION CARRIERS



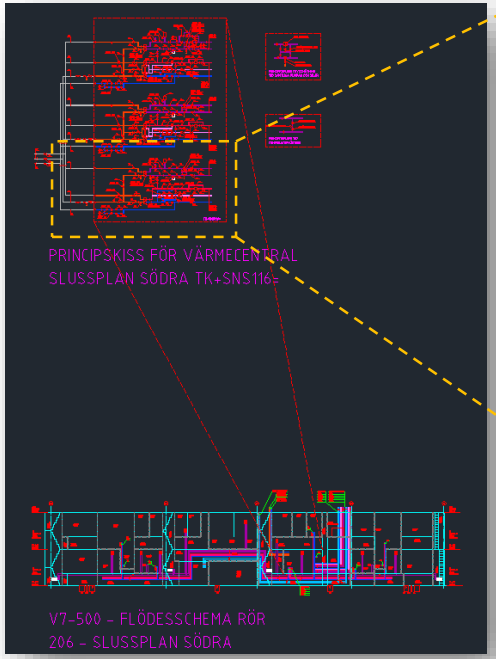
ICON

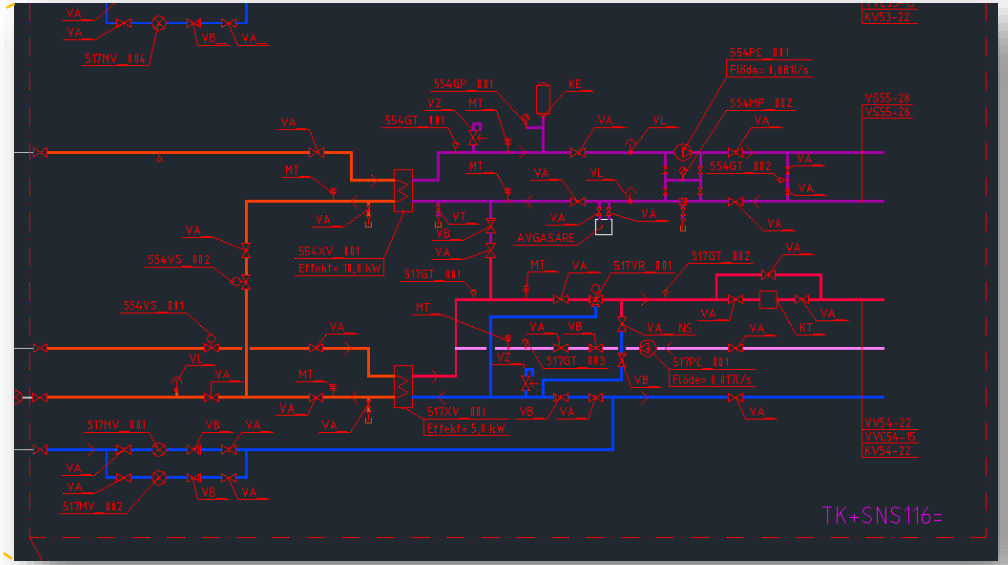


EXAMPLE

EXAMPLE-CM

SCHEMATIC MODEL (2D-CAD)

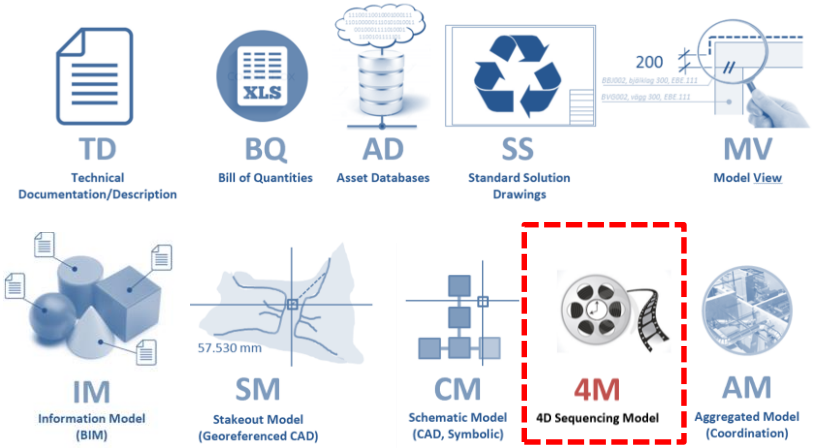




- Not georefered graphics
- Flowcharts for plumbing installations
- All flow charts for each technology area in a single model
- To be used digitally but can be printed

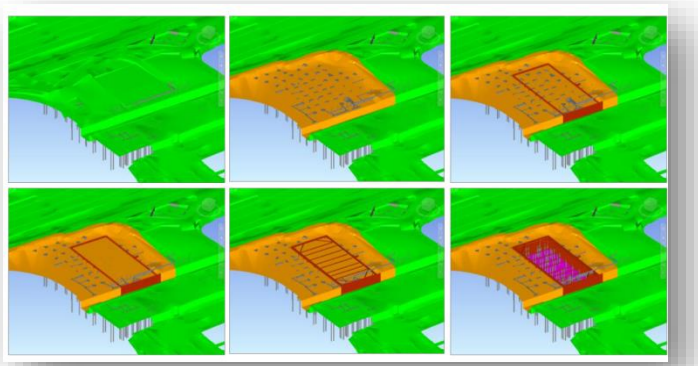
INFORMATION CARRIER – 4M

4D SEQUENCING MODEL



4M

4D Sequencing Model



PALETTE WITH 10 INFORMATION CARRIERS

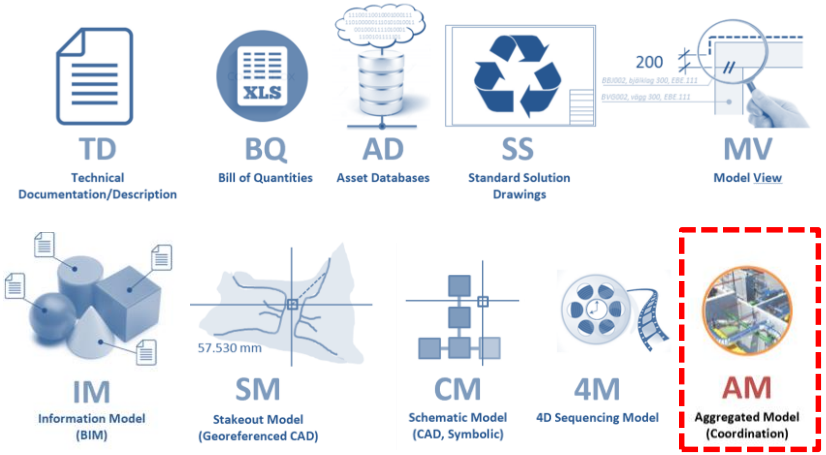
- Purpose to illustrate required erection order in 3D
- One view for each stage
- Corresponds to Technical Description (TD)
- Contains more objects than the actual delivery. Example existing conditions
- The example above is av escavation and a large sheet pile construction for foundation

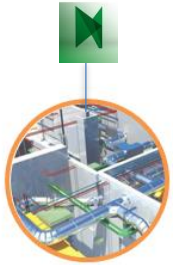
ICON

EXAMPLE

INFORMATION CARRIER - AM

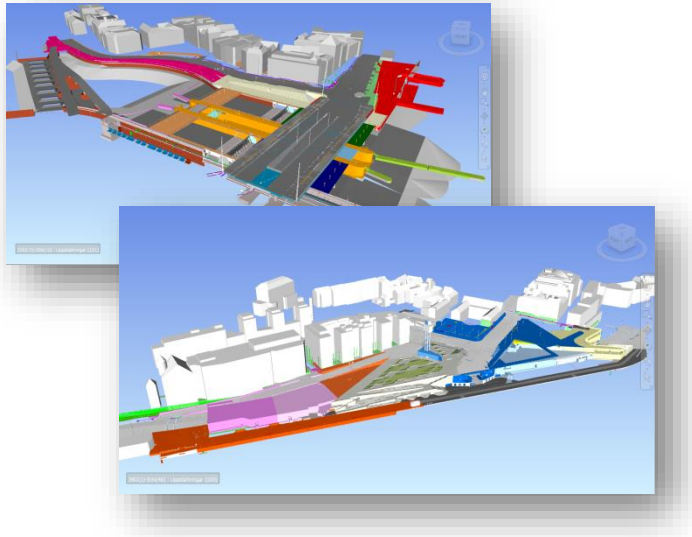
AGGREGATED MODEL
(COORDINATION & DELIVERY ORIENTATION)





AM

Aggregated Model (Coordination/Orientation)



PALETTE WITH 10 PSC INFORMATION CARRIERS

ICON

EXAMPLE

- Includes all objects in the project – Different parts in different stages (system/detailed design)
- Includes sketch objects, sharp objects, objects in review, objects already delivered. Includes everything
- Model are updated each week for overview and coordination.
- All IM are included in AM. The purpose is to see each IM in its context.

REVIEWING AND PRODUCTION PLANNING IN VR

- Spread models to NON-BIMmers
- Reviewing
- Coordination
- Production planning
- Quality Safe before delivery

PUBLIC COMMUNICATION IN VR

tikab ELU


Thanks!
johanstribeck