Royal HaskoningDHV
Enhancing Society Together

DigiShape - Digital Engineering

From parametric design to integrated workflows

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Open
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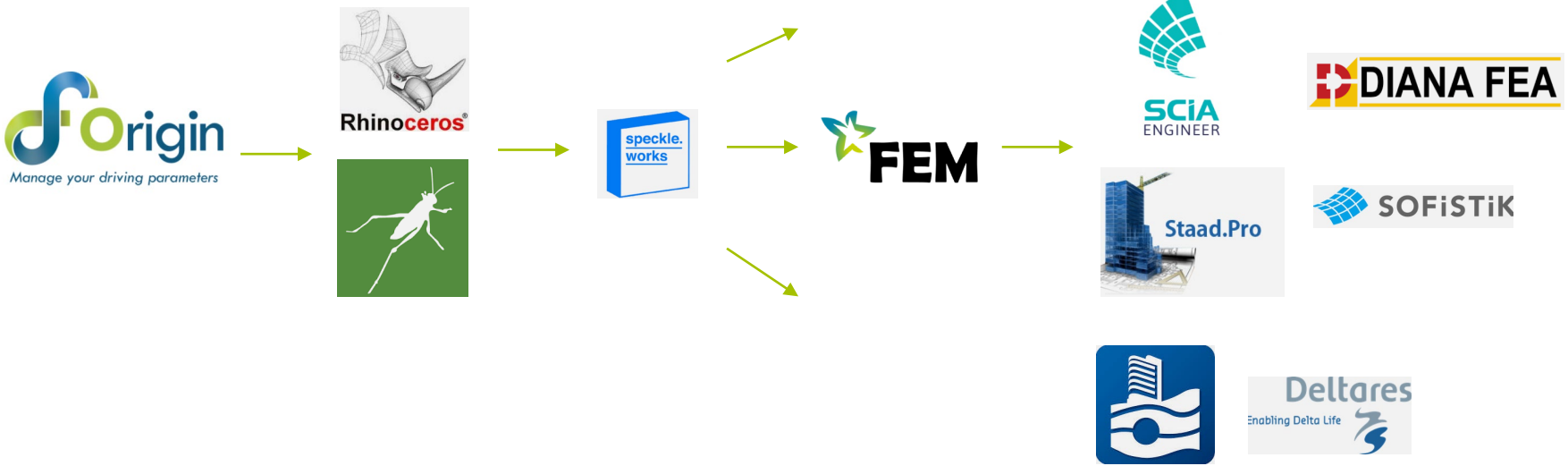
A bit about myself…

- Dennis Broere
- Age: half a century
- Married to Natasha and father of Tessa (17), Barend (15) and Ellen (12)
- Civil Engineer
- Royal HaskoningDHV since 2006
- Digital Lead for Global Leading Market ‘Maritime’
- E-mail: dennis.broere@rhdhv.com

Parametric design

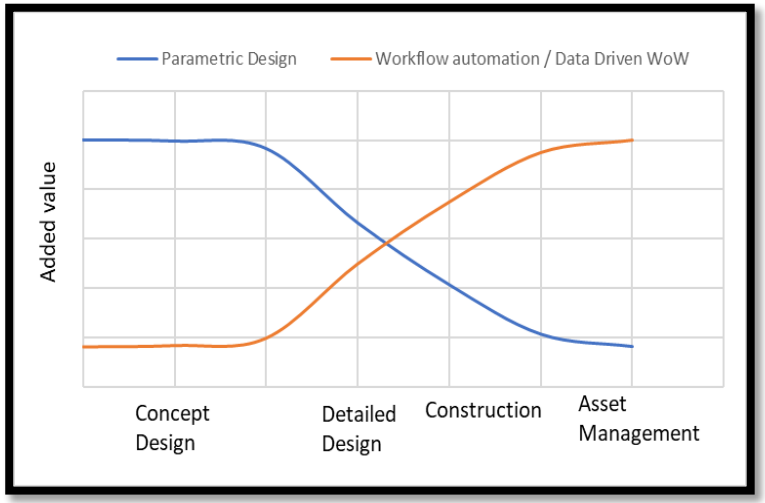
Shaping components & structures using algorithmic processes,
e.g. for a jetty:

- Deck/seabed level
- Width of jetty
- Span
- # of piles per support



How to maximize added value?

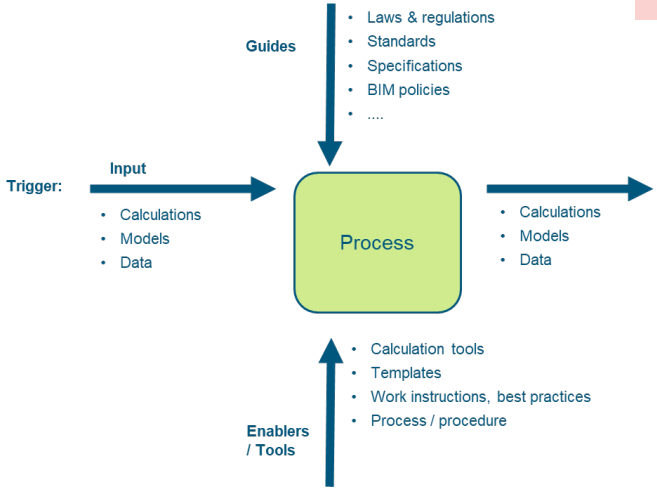
- Parametric design enables better design solutions in the early stage (scenarios, alternatives, quick updates, etc.)
- However:
  - Parametric tools are (going to be) developed on an individual basis, but
  - the flow of information should be generic



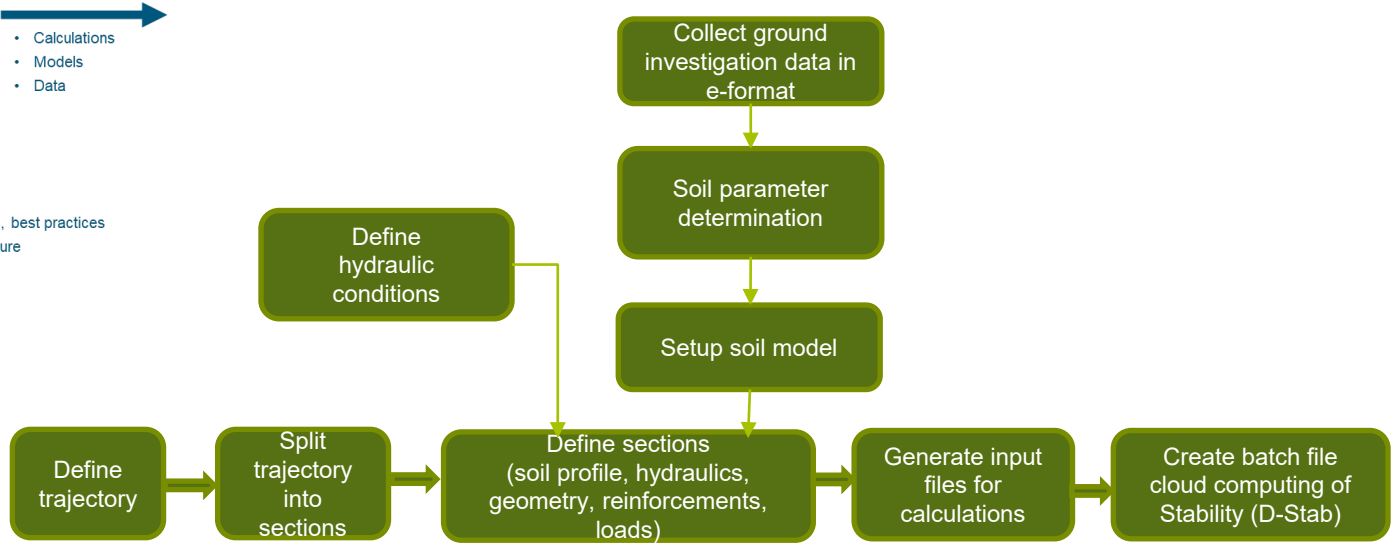
- Real value is in streamlining communication and collaboration between stakeholders and parties, throughout the Asset Life cycle (read: Client/Owner, Design and Engineering consultancy, Contractors, and Operators) ➔
  - Map the processes, and
  - Standardize the exchange of information

Integrated workflows using process mapping

You need to standardize before you can automate anything!



Example for stability check for dike trajectories:



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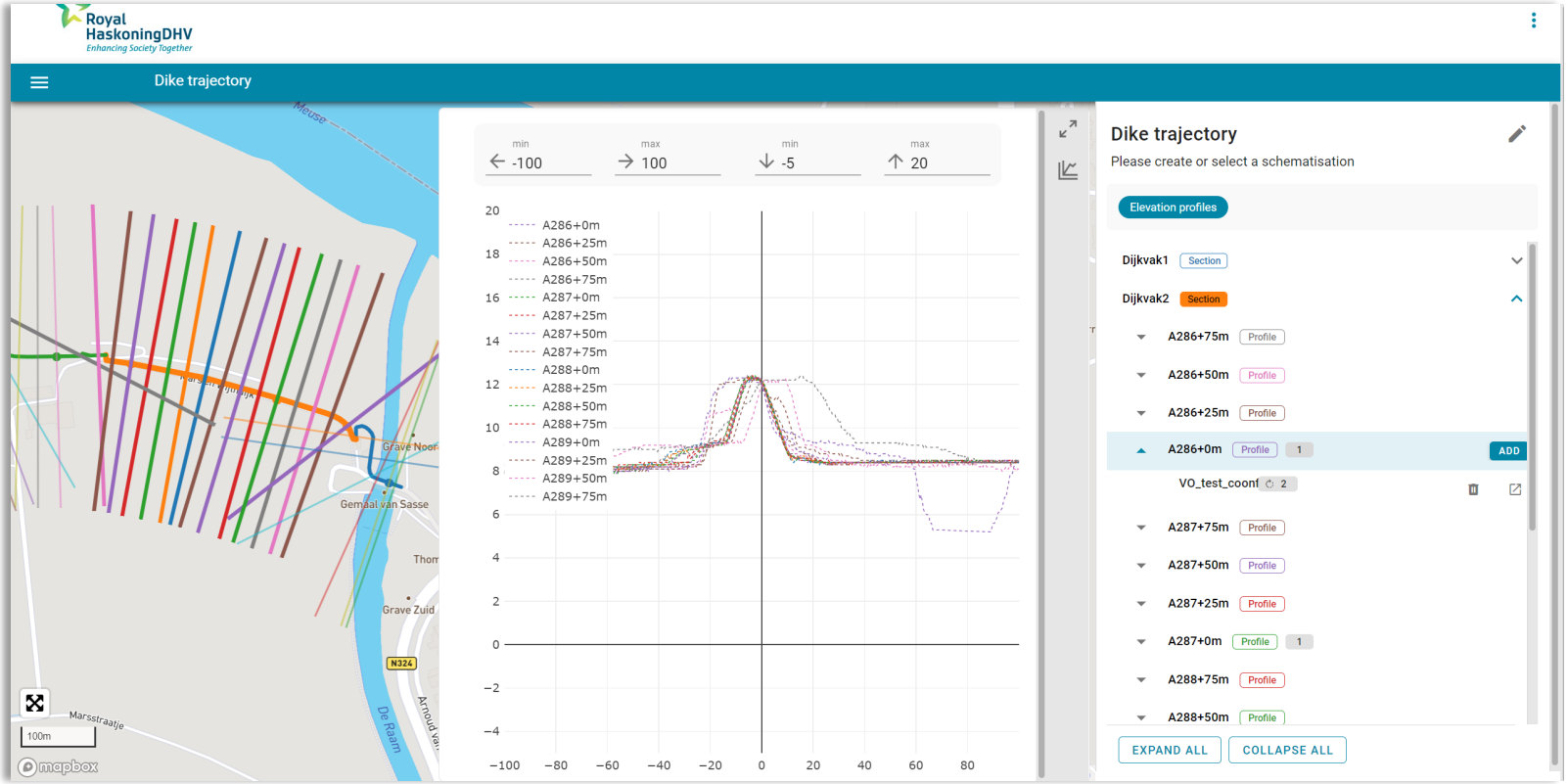
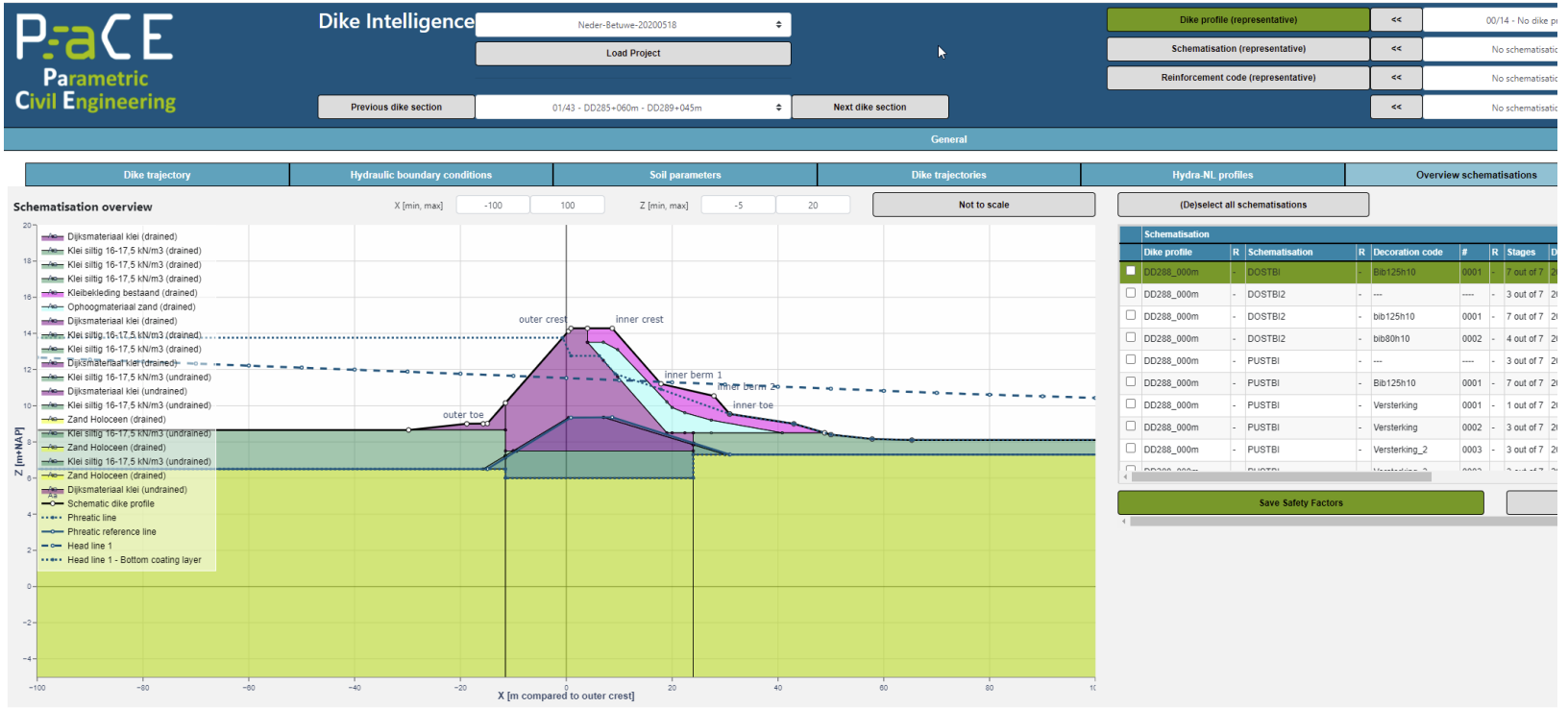
Integrated workflow for dike reinforcement



Integrated workflow for dike reinforcement



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From OTL to integrated workflow

Object Type Library (Objecten)

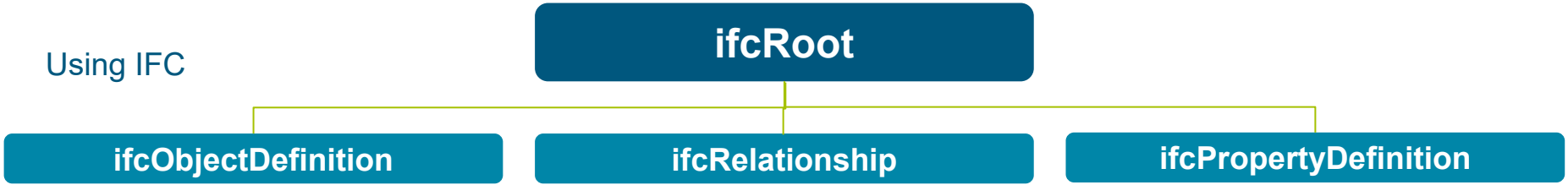
- Drijvende afmeervoorzieningen
- Glooiingen
- Kademuren
  - Afwateringsvoorzieningen
  - Bodem(bescherming) & talud
  - Bovenbouw
  - ….
  - Trosvoorzieningen
    - Bolder
    - Sliphaak

Object Type Library (Eigenschappen)

- Functie
- Kleur
- Leverancier
- Materiaal

(AM focussed)

Using IFC

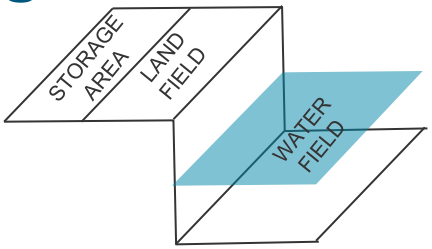


OTL + IFC = Parametric design enabled for all

Industry Foundation Class (IFC), what is it?

- IFC is a standardized, digital description of the built environment (LINK)
- Enables collaboration in all phases of project (initiation > design > construction > operation)
- The purpose of IFC: Exchange of information between different software applications
- It's an open – vendor neutral – international standard (ISO 16739-1:2018)
- It is developed/maintained by the non-profit organisation bSI (buildingSmartInternational)
- IFC4.3 for infrastructure (current status: DIS → Draft Int. Standard)

IFC4.3 Spatial Hierarchy – where to find things



IfcProject

IfcSite

IfcFacility

Super Type

Type

IfcBuilding

IfcRoad

IfcRailway

IfcBridge

IfcMarineFacility

Type Enumeration Examples

QUAY

JETTY

NAVIGATION CHANNEL

BREAKWATER

Super Type

IfcFacilityPart

Type

IfcMarinePart

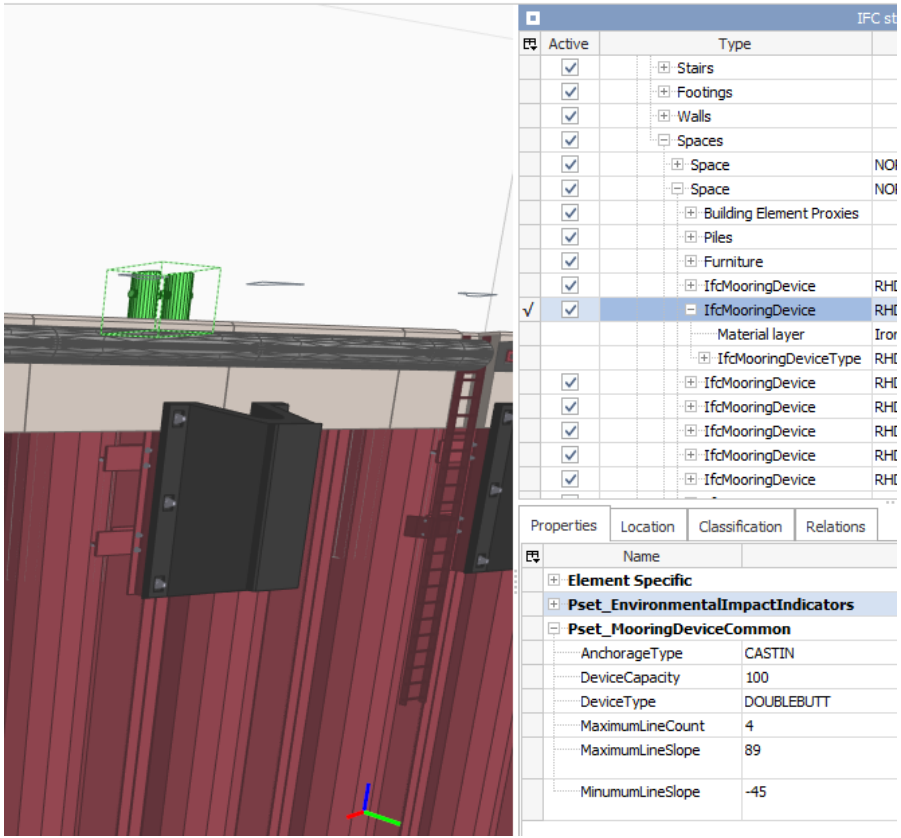
Type Enumeration Examples

STORAGE AREA

LAND FIELD

WATER FIELD

IFC4.3 Property Sets



Data Dictionaries

bSDD
a service by buildingSMART International

Linked data
https://identifier.buildingsmart.org/uri/buildingsmart/ifc/4.3/class/IfcMooringDevice/prop/Pset_MooringDeviceCommon

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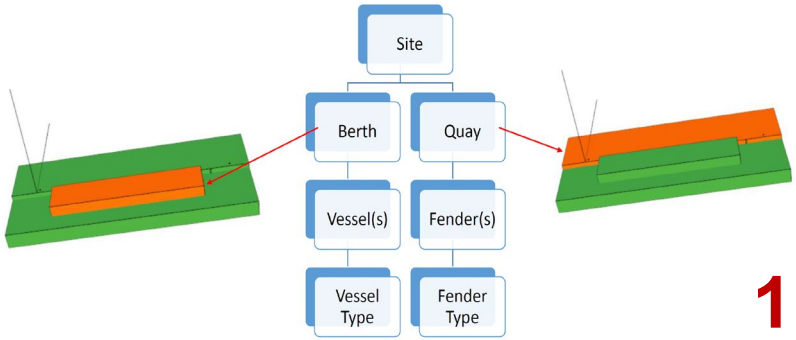
IFC4.3 use case example

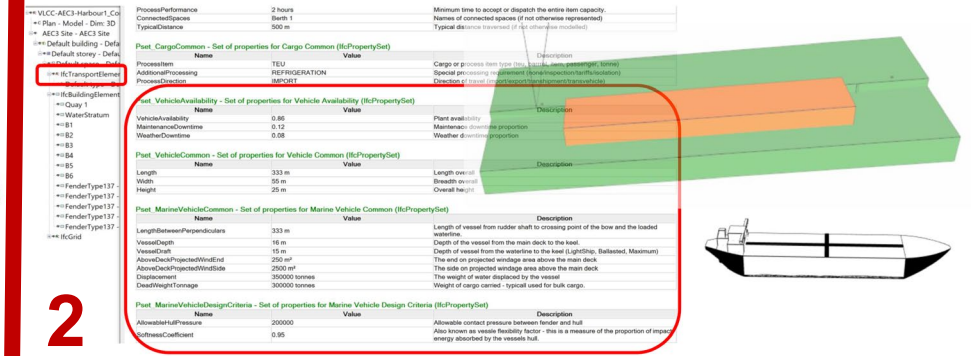
Berthing analysis

Data for Berth and Quay



1

Berth Data from the Model – Design



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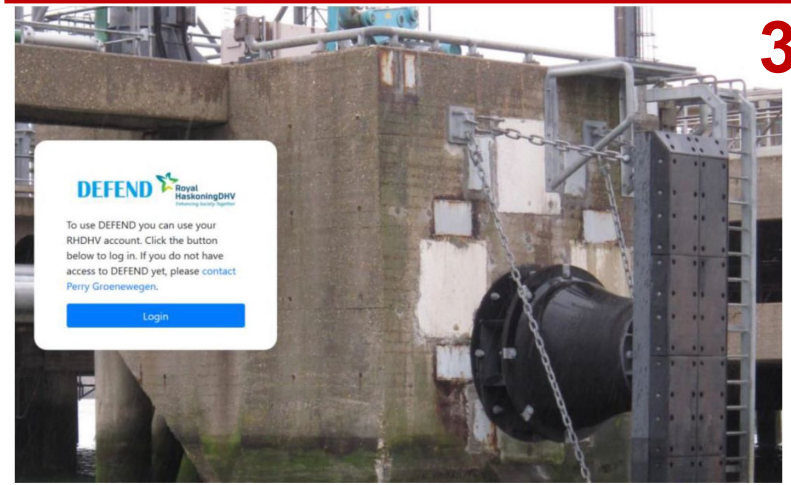

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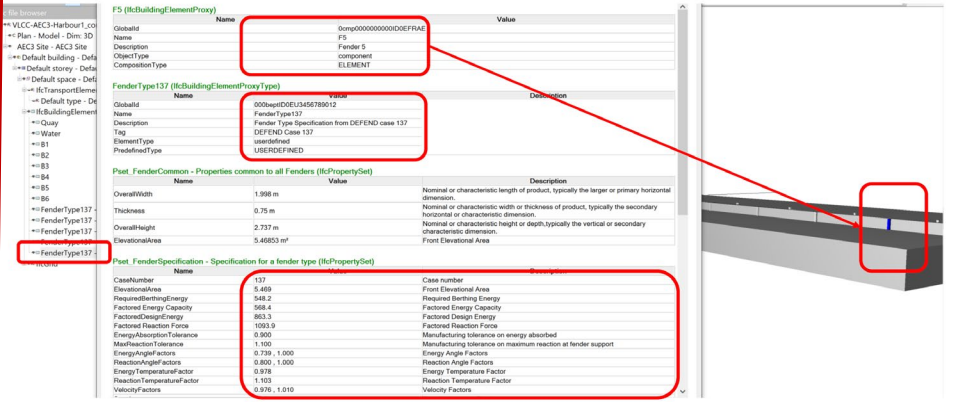
4 Berthing Analysis Results Back to IFC



My plea for today

Boost the uptake of IFC4.3

- Activities that spring to mind:
  - Review PoR object library and map it to IFC
  - Create a PoR domain on the BuildingSMART Data Dictionary
  - Create other domains relevant to the Dutch Market (e.g. dredging → define sand!)

Why?

- API and software development kit is free available
- Would allow to automatically:
  - search a model for objects, and
  - add properties to the objects (verification, design, construction, AM,…)
- To facilitate parametric design

NB: Example from Norwegian Road Data Base: classification system with property sets (link)