



# **DigiShape - Digital Engineering**

From parametric design to integrated workflows

BG6404-RHD-DW-WM-PP-Z-0057 **Open** Dennis Broere 11 October 2023

## 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





Deltares

Enabling Delta Life

**REVIT** 

### 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 <u>collaboration between stakeholders</u> 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



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### Integrated workflow for dike reinforcement



## Integrated workflow for dike reinforcement



#### **Object Type Library** (Objecten)

- Drijvende afmeervoorzieningen
- •

## From OTL to integrated workflow



### **OTL + IFC = Parametric design enabled for all**

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### Industry Foundation Class (IFC), what is it?

- IFC is a standardized, digital description of the built environment (LINK)
- Enables <u>collaboration in all phases</u> of project (initiation > design > construction > operation)
- The purpose of IFC: <u>Exchange of information</u> 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**



### **IFC4.3 Property Sets**



Data Dictionaries **Dota Dictionaries Dista D** 

### IFC4.3 use case example

### Data for Berth and Quay



### **Berth Data from the Model – Design**

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taintenanceDowntime 0.12 Maintenance downtime proportion
VeetherDowntime 0.08 Weether downtime proportion
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ength 333 m Length overall
Weth 55 m Breadth overall
teight 25 m Overall height
set MarineVehicleCommon - Set of properties for Marine Vehicle Common (IfcPropertySet)
Name Value Description
engh/Between/Perpendiculars 333 m Length of vessel from rudder shaft to crossing point of the bow and the loaded within the control of the bow and the bow a
esselDepth 16 m Depth of the vessel from the main deck to the keel.
esselDraft 15 m Depth of vessel from the waterline to the keel (LightShip, Ballasted, Maximum)
boveDeckProjectedWindEnd 250 m <sup>2</sup> The end on projected windage area above the main deck
boveDackProjectedWindSide 2500 m <sup>2</sup> The side on projected windage area above the main deck
Naplacement 350000 tonnes The weight of water displaced by the vessel
ReadWeightTonnage 300000 tonnes Weight of cargo carried - typicall used for bulk cargo.



### **4**Berthing Analysis Results Back to IFC

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ReactionAngleFactors	0.800, 1.000	Reaction Ang	le Factors	
EnergyTemperatureFai	ctor 0.978	Energy Temp	arature Factor	
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# 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  $\rightarrow$  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)