# BIM and Systems Engineering



#### Dr. Arjen Adriaanse BIM Program Manager, Manager BIM Center

5Di Conference Lake Constance – May 22 2012



#### Outlook

- How is BIM currently used within Ballast Nedam?
- What is Systems Engineering?
- How can BIM and Systems Engineering be integrated?



## **Building process integration**





#### **BIM and power plant projects**





#### **BIM and infrastructure projects**



#### **BIM and railway station projects**





### What is Systems Engineering



What the client	How this was	The design	The product	How it was	The	The client's
asked for	interpreted			corrected	documentation	need

- Structured requirement specification
- Select solutions by considering the complete lifecycle (meet requirements in an efficient way)
- Explicitly review whether or not requirements are met
- Explicit documentation of information









#### **Information structures Systems Engineering & BIM**





### **5Di Systems Architecture**





1. Search / select 3D objects through one of the breakdown structures.





# 2. Assess the requirements that are applied to a selected 3D object.

Requirements that apply to selected object

For example:

Floor needs to bear a load of 2,5  $kN/m^2$ .





#### 3. Compare designed alternatives in one view.



Design

Alternative A

Alternative **B** 



4. Virtually verify compliancy using rule-based checking. Comparing required performance against designed and actual performance.



Verification Module									
Comparison condition									
Name		Condition	Name						
Min. area		<=	Area						
Roomnumber	Roomname	Required Property	Condition	Designed Property					
F0.1	cel	7.0	<=	7.2					
F0.2	cel	7.0	<=	7.2					
F0.3	cel	7.0	<=	7.3					
F0.4	office	6.5	<=	6.2					
F0.5	storage	2.0	<=	2.0					
F0.6	archive	12.0	<=	12.2					
F0.7	archive	10.0	<=	9.8					
				-					



5. Connect QC results and non-conformancies to the 3D objects.





#### Conclusions

- How is BIM currently used within Ballast Nedam?
  - In all large projects, main objective: building process integration
  - Systems Engineering is applied but not yet integrated with BIM
- What is Systems Engineering?
  - Structured life cycle approach focussing on (meeting) requirements
  - Origin in other industries, (parts) adopted by clients and contractors
  - Main benefit BIM integration: SE data available in BIM environment
- How can BIM and Systems Engineering be integrated?
  - Bringing them into one architecture (systems, information)
  - Develop requirements regarding functionalities (50 in 5Di Use Case)





