

OPTIMIZING THE USE OF CRITICAL MATERIALS IN THE BUILT ENVIRONMENT USING BIM

This framework is part of a Thesis research of the Master track Building Technology at Delft University of Technology.

Goals of this framework:

- Facilitate knowledge and solutions of critical materials in the built environment.
- Optimize material selection processes and application of materials for building products.
- Provide a standardized dataset which can be linked to large scale stocks and flow projects.
- Inform stakeholders during the whole life time of a building about critical materials.

CRITICAL MATERIALS
List European Commission 2017

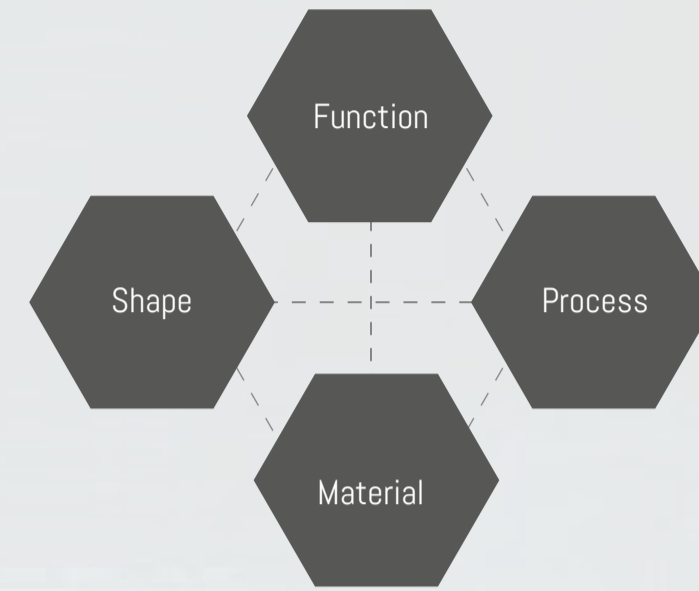
Antimony	Hafnium	Phosphorus
Baryte	Helium	Scandium
Beryllium	HREE and	Silicon metal
Bismuth	LREEs (16)	Tantalum
Borate	Indium	Tungsten
Cobalt	Magnesium	Vanadium
Coking coals	Natural graphite	
Fluorspar	Natural rubber	
Gallium	Niobium	
Germanium	PGMs (6)	

- Parameters:
- Economic importance (end-use applications and manufacturing industries)
 - Supply risk (risk of disruption in EU supply based on concentrations primarily supply)

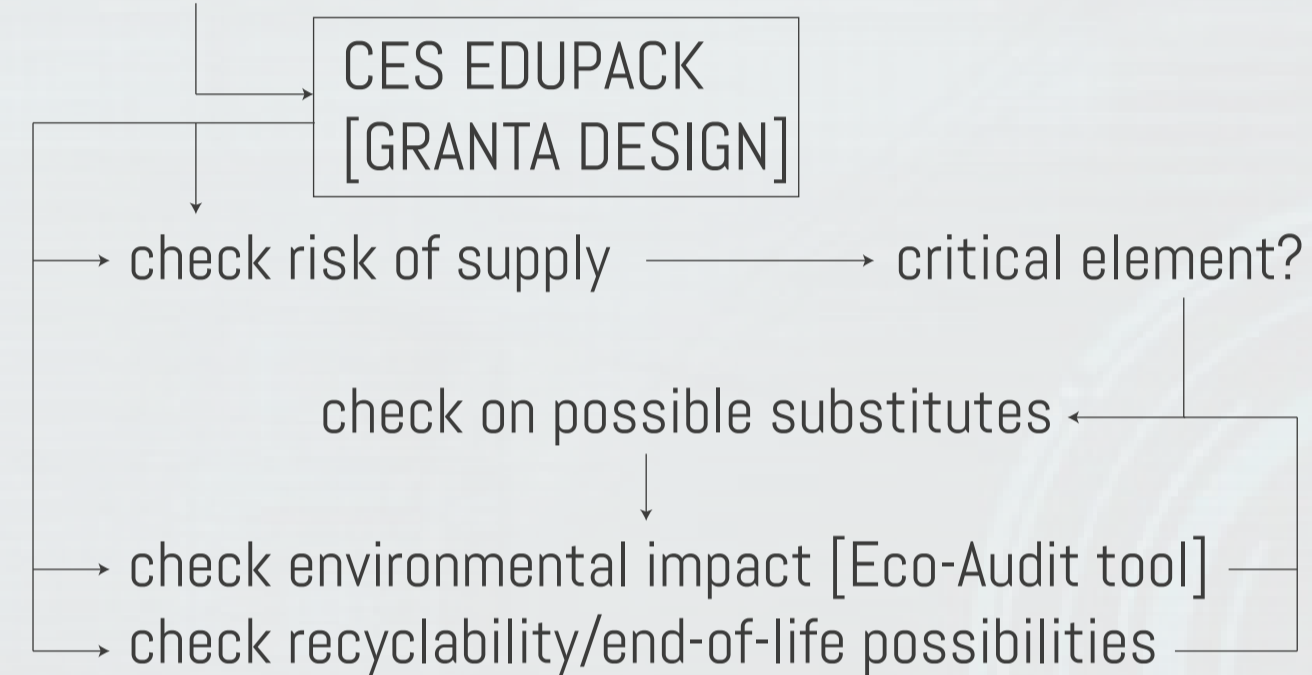
note:
· criticality might change during building lifetime; take more into account than only the EU list.

MATERIAL SELECTION

Function, shape, process and material can not be seen separate.



select materials based on (functional) properties



OPTIMIZE LIFETIME MATERIALS

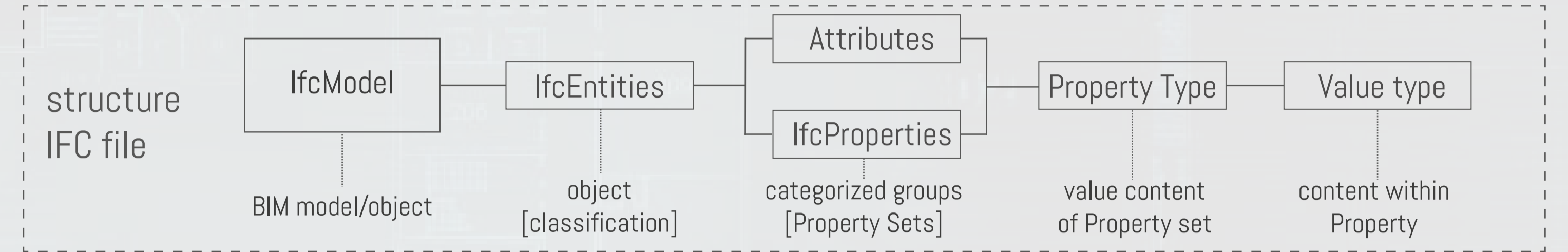
design for longer lifetime
physical, functional, technical, economic, legal and desirable

technical;
durable/high quality materials, modularity: updateable, repairable and remanufacturable
re-usable components;
standardized components, dry connections
recyclable materials;
combination of materials

social and economical change;
business model, responsibilities, maintenance, raise awareness

BIM-BASED DOCUMENTATION

This overview presents a standardized data set in Industry Foundation Class (IFC), which is available for all BIM applications. The acquired data and linked Property Sets aim to optimize the lifetime of materials and facilitate knowledge of critical materials.



	content	Property Set	Value + Type
general information	name	Attributes	IfcLabel; Single Value
	description	Attributes	IfcText; Single Value
	type	Attributes	IfcText; Single Value
	article number	Attributes	IfcLabel; Single Value
	installation date	Pset_Manufacturer	IfcLabel; Reference Value
	product description	Pset_Manufacturer	IfcText; Single Value; hyper-
materials	Bill of Materials list, weight and origin	Pset_MaterialCycle	IfcText; Single Value; hyperlink
	list of all elements	Pset_SubstanceCommon	IfcText; List Value
	critical materials EU 2017	Pset_SubstanceCommon	IfcBoolean; Single Value
	CRM factor	Pset_SubstanceCommon	IfcBoolean; Single Value
	hazardous substances	Pset_SubstanceCommon	IfcBoolean; Single Value
	conflict materials	Pset_SubstanceCommon	IfcBoolean; Single Value
optimize lifetime	production year	Pset_Manufacturer	IfcLabel; Reference Value
	expected lifetime	Pset_Manufacturer	IfcLText; Single Value
	use guide	Pset_Operation	IfcText; Single Value; hyperlink
	maintenance guide	Pset_Operation	IfcText; Single Value; hyperlink
	installation guide	Pset_Operation	IfcText; Single Value; hyperlink
circularity	list of components	Pset_MaterialCycle	IfcText; List Value
	reusable components	Pset_MaterialCycle	IfcText; List Value
	reference reusability	Pset_MaterialCycle	IfcText; Single Value; hyperlink
	reused components	Pset_MaterialCycle	IfcText; List Value
	joining techniques	Pset_MaterialCycle	IfcText; Single Value; (hyperlink)
guideliness EoL treatment	Pset_Manufacturer	IfcText; Single Value; hyper-	
manufacture	manufacturer	Pset_Manufacturer	IfcLText; Single Value
	sub-manufacturers	Pset_Manufacturer	IfcLText; List Value
	ownership	Pset_BusinessModel	IfcText; SingleValue
	businessmodel	Pset_BusinessModel	IfcText; SingleValue; hyperlink