Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences

Graduation Plan: All tracks

The graduation plan consists of at least the following data/segments:

Personal information	
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Studio	
Name / Theme	**Sustainable graduation studio; Building technology; Façade design**
Teachers	Arie Bergsma, Winfried Meijer, (Andy van Dobblestien)
Argumentation of choice of the studio	
Graduation project	
Title of the graduation project	BIM For Facade
Goal	
Location:	Netherlands
The posed problem,	It is said that in UK already by 2016, the government will mandate BIM for all centrally procured government contracts. The Dutch government (Rijksgebouwendienst or Rgd) in a 14th June 2012 presentation mentions also to mandate BIM for most of its government projects. What's more, many big and small industries are taking steps towards BIM. BIM by itself is becoming increasing famous but also infamous. It is popular in the new generation of architects and developers but it comes with some drawbacks. Many claim that using BIM helps in reducing risks, savings in cost and reduction in CO2 emission. But how much of this is true? On the otherhand since it is one singular model for all consultants, who will take the liability of information, who is allowed to change information and how do the consultants transfer data to other softwares for a detailed calculation? To answer this, it is important to understand how to use BIM and more so, how

	is the information provided in BIM be useful in the further phases of project. Although BIM is popular, there are still hiccups in its application. The main reason being the 2-d libraries are inefficient in solving problems of seeing them in a 3-d realistic way. The 3d models available are either so detailed that the files crash at the design stage (where more flexibility and hence geometric information is required which increases the file size) or too simplistic when integrating all the elements. Hence, these models are redrawn by every consultant at different stages to match their requirement. This is problem is also seen in the façade industry. When we look at the design stages, we see that the actual BIM information is added only post the contract stage, while in the design stage, only system suppliers are considered. Although many industries already have started developing libraries in BIM, the facade industry in The Netherlands is still not far ahead. However, there is curiosity and demand from the industry to make this step and VMRG is taking lead in this. However, to develop a library, it is important to know what stage-wise information is required by the architects and how will the provided information be used in the subsequent / final stage of BIM, whilst being on minimal risk.
research questions and	(main) How to effectively define BIM library for metal facade cladding elements for a designer's use at the concept design phase? (sub) o What kinds of data should be included at what stages? o How to transfer data for different consultants? o How to combine knowledge based engineering effectively? o What (basic) standards should be

	applied when we are talking about facade? o How it relates in a real, ongoing, project?
Design assignment in which these result.	Design a (example) library for metal façade cladding elements that has the relevant information an architect needs during the design phase. This will also include exchange formats for subsequent consultants, BIM standards suggestion and methods of adding data in the subsequent stages.

This should be formulated in such a way that the graduation project can answer these questions.
The definition of the problem has to be significant to a clearly defined area of research and design.

Process

Method description

(Also refer fig.1)

To define the methodology, it is essential to define the following two aspects:

1. Define who this research is for and at what stage
2. Define the traditional method- comparison through knowledge based engineering

The methodology takes place in 2 steps:

A. Learning from the current:
   1. Project case-studies where BIM is used in for the whole building.
   2. Learning from other industries: insulation/ wood/ piping etc.
   3. Analysis of the current 2d libraries in facade.
   4. Current standards- COBie (UK) and NBIMS (US).

B. Analysis of the kind of information required (for facade) at what stage of building design.

   1. This includes interviews of architects, facade designers, contractors and software developers.
   2. Determining the level of development (LOD) and depth of detail (DOD).
   3. Defining the data assessment criteria- as per knowledge based engineering (traditional method).

4. Data exchange between consultants.

- Finally, this will lead to defining a BIM library with understanding of its applications for different consultants at different stages.

- Testing the effectiveness of the library by applying it to the real projects and making necessary changes as per recommendations.

- Evaluations and conclusions.

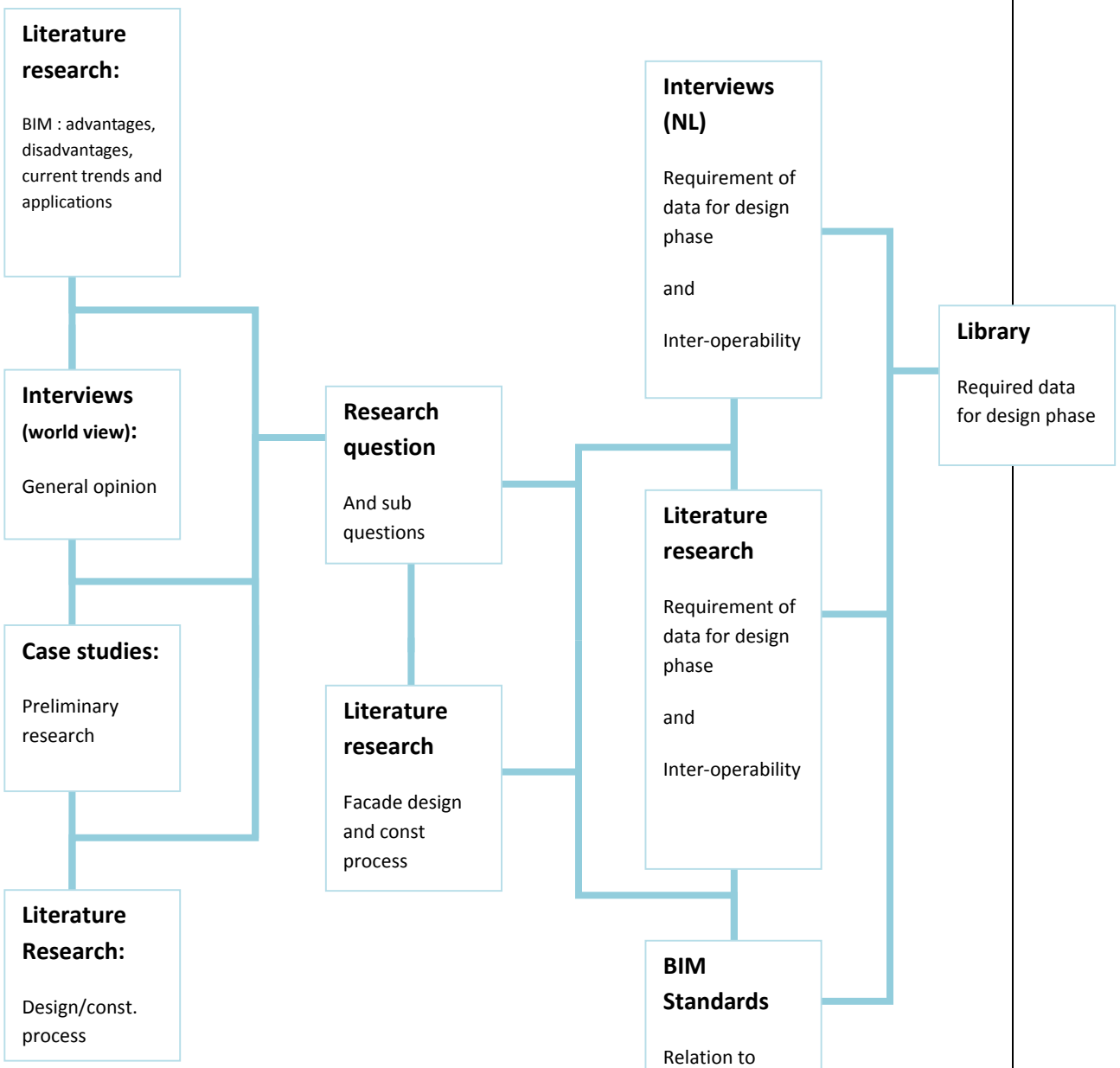

Fig 1: methodology

Literature and general practical preference

In addition to the various fragmented sources where research and inferences are based from, the following is a list of the main sources of data where research will be (and is already being) studied.

TYPE OF DOCUMENT	TITLE/ URL	AUTHOR	YEAR	PLACE
Book	BIM Handbook: *A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors*	Eastman, C., Teicholz, P., Sacks, R., & Liston, K.	2008	New Jersey Unites State of America
BOOK: PHD Thesis,	*Intergral Facade Construction.*	Tillmann Klein	2013	TU Delft, Th Netherland
Book	Building Information Modeling: A *Strategic implementation Guide for Architects, Engineers, Constructors and Real Estate Asset Managers*	Smmith, D. K., Tardif, M.	2009	New Jersey Unites State of America
Book	Building Information Modeling	Kymmell, Willem		
Manual	*Adopting BIM for Facilities Management: Solutions for Managing the Sydney Opera House*	CRC Construction Innovation	2007	Cooperative Research Ce for Construc Innovation, Brisbane, Australia.
Website	Construction- Operations Building Information Exchange (Cobie) (www.wbdg.org)	Bill East (National Institute of Building Sciences)		Washingtor D.C., USA.
Website	http://www.nationalbimstandard.org/	National Institute of Building Sciences buildingSMART alliance		Washingtor D.c., U.S.A.
Website	http://www.rijksvastgoedbedrijf.nl/	Rijksgebouwendienst: Ministry of the Interior and Kingdom Relations (Ministerie van Binnenlandse zaken en Koninkrijksrelaties)	--	The Netherland
Website	BIM Forum	http://bimforum.org/lod/	--	
Website	www.autodesk.com	Autodesk	--	-
website	www.building.co.uk	UBM (UK) Ltd	--	London, U.I
Website	www.bimobject.com (more info: http://info.bimobject.com/bimobject-offices)	BIMobject ® Corporation (digital content management system	--	

Website	http://www.buildingsmart-tech.org/	The buildingSMART International commitee	--	
Website	BS 1192	BSI (British Standards Group)	--	
Various	VMRG + memeber companies	--	--	The Netherlands

A second basis of the research is dependent on interviews of people (at least 3 from each field mentioned below). This will give a wider view. The following are a list of companies/ people that are involved in BIM and contacted (via VMRG), with whom a further interview will be carried out (in Phase P3)

Field	Companies
Facade engineering	• Alkondor • Kolf & Molijn • JAZO
Software companies	• CADAC • ITANEX
Contractor	• IBB Kondor
Architect	• Van Den Berg Architecten • Atelier Pro

Reflection

Relevance

This research has a twofold effect.

1. AEC industry in The Netherlands:

In the Netherlands, wood (facade) industry already has a BIM library available. However, there is no additional data other then providing a mere 3-d geometric definition with available sizes. However, in initial talks, the architects confirm that a relevant data, for instance fire rating or LCA, that would be helpful in the initial stages. Also, there is, as of today, no comparison available between wood and other material. VMRG (a Dutch facade company) on the other hand, is currently working on providing information to its 90+ companies and a 100+ system suppliers (related in metal industry) about how to make the step between products and architects smoother. This thesis will help in providing essential data in generation of this library- by pointing the data needed and a handbook of how to use this data in further stages. This is expected to avoid major re-drawing of models and smoother data transfer

between architects and other consultants.

2. Personal Development and use of BIM further:

This research has also potential of huge improvement in personal knowledge. With this thesis, it will help me to connect the theoretical knowledge learned in University with the actual application of this knowledge. This will connect the new generation that uses new technologies with the strategies actually developed in the construction industry thus, providing an effort to bridging the gap.

Time planning

The graduation thesis is divided into 4 time slots: until p2, p2 to p3, p3 to p4 and p4 to p5

The first slot examines literature research. This includes scope of BIM, where is it already used, its advantages and disadvantages/ shortcomings and the current technologies (and related problems). This is studied parallel to the design and construction process and role of BIM. All this research will result in defining the topic and its extent.

From the research analysis so far, the direction of thesis will be in developing library for the metal facade industry for architects and at design phase. The remaining slots (between p2-p5) will be spent in defining the library requirements for stage 2 BIM or LOD 200. This is because this library is easy enough to work with the design but has enough information to move to the tender stage.

The second slot is dedicated to completing the literature research. This includes existing BIM standard guidelines (COBie, NMIMS, and the RGD or the Dutch standards) which are not concrete rules but a general guideline. This stage also includes defining exchange formats, depending on the consultant to whom the data has to be transferred. it also includes interviews with the professional world and defining the criteria of library or in simple words, the data requirement for the design phase. A comparison of the 2d library used at this stage and analysis of what's helpful and what is missing will be instrumental in defining the library criteria.

The next step is identifying the range of data required at the design stage and comparing with the range of data available on market to make a guideline (for example range of profile size for window and categorizing into 15 or 20 types based on sizes, this also follows for energy performance, fire rating etc). The next step is to link them and find common grounds for categorizing.

In the third slot, these will be developed to its final face and the standards will be reviewed to see if they are in sync with the defined library requirements. In this stage, a set of convenient existing softwares has to be identified for the application of the design of library. These should reflect convenience of working and file exchange formats.

The fourth and final slot will be focused on reviewing the work and making sure all the pieces work together in the final report. A “how to” guide will be written which will guide the users to the library and to the next stage in using BIM. if time permits, a part of library will be put to test in a real project. This slot will also focus on reflection and suggest possible improvement directions.

Week	2.7	2.8	2.9	2.10	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	3.10	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	4.10
				P2									P3						P4					P5
Activities																								
BIM Definition																								
BIM- literature study																								
Case Studies																								
Softwares and methods for design&logistics																								
Existing BIM standards																								
Interviews 1.0																								
Problem statement																								
Defining comparison criteria																								
Current 2d library																								
3D- Library Criteria and definition																								
Interview 2.0																								
KBE- data assessment criteria																								
Comparision with BIM standards																								
Defining example library																								
Testing the library																								
Adjustments in library																								
Presentation Preparation				P2									P3						P4					P5

Fig 2: Time planning