NATURAL TECTONIC CRAFT: *investigating the cultural and economic value of exposed structural timber*

SUMMARY

The proposal positions wood as a tectonic catalyst for achieving a more human-centered, and environmentally conscientious architecture. Through in-situ survey, precedent analysis, and interview, it will explore the shift in technology between craft-based Finnish wood structures and the institutionalization of structural steel in attempt to address questions relevant to current architectural practice. Analysis will be approached from the perspective of craft-based toolsets and technological methods as a means to close the utilization gap between exposed structural steel and its wood counterpart.

INTRODUCTION/ EXPLANATION OF ISSUES

Today our bodies are constantly subjected to what Juhani Pallasmaa calls commercial manipulation[1]. We are bombarded with advertisements encouraging us to consume, discard, and demand more from goods and services. Increasingly the human element in day-to-day life has become dispensable, and is being replaced by a sophisticated system of digital intelligence. Pallasmaa and other phenomenologists argue that because of this, the role of art and architecture should not be manipulator of occupant or observer, but rather the liberator through poetic and guiding experiences that help reinforce critical qualities of being human. My work pursues this sentiment, but I also believe that our field requires the innovation of technology/digital tools in order to help realize these poetic moments more efficiently. Through this study I hope to emphasize a craft-based architectural tradition, which then informs technological methods, in order to increase the obtainability of human-focused design.

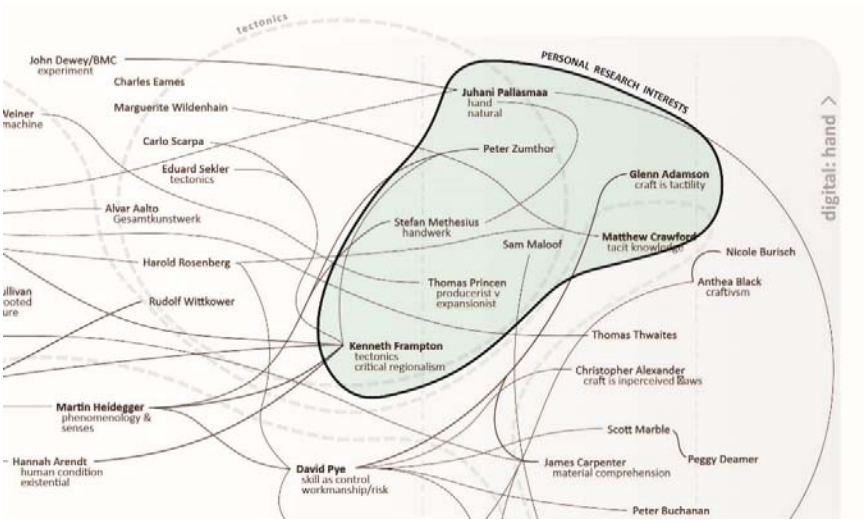


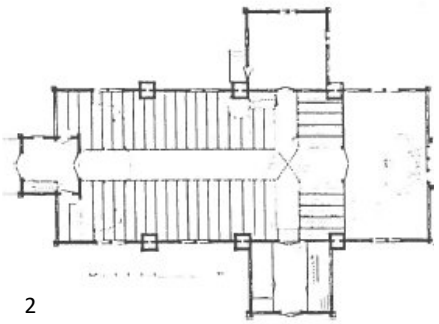
Figure 1: Personal research interests within the larger framework of design theory. *Mind Map, Stevens & Knauss*

Authenticity in tectonics is one way I believe in which architecture can poetically prompt the qualities of natural human experience. Kenneth Frampton asserts that culture is able to express itself through the joint, not an

arbitrary form or trendy style[2]. I want to gain a better understanding of Finland's wood building culture and the origin of these traditions of working with timber, explore the skill it took to achieve early wood structures, and set the groundwork for principles that might be able to be extracted for modern application. Therefore, presented with the opportunity, I wish to travel throughout Finland to investigate and document tacit knowledge, historical records, and technological methods in order to open up opportunities for new knowledge and better practice.

HISTORICAL SURVEY

Wood construction dominated the vernacular of traditional Finnish structures, as it did for most nations with adjacency to boreal forest. The Finns are famous for their saunas and *kota* huts (barbeque shelters), but were not the first to develop wood as a primary building material. Timber cornering was practiced as early as the Roman Empire and made its way across Europe as early as first century BC[3]. According to Lars Pettersson, however, one traditional timber craft is uniquely specific to Finland: *tukipilarikirkko*, or block-pillar church construction[4]. Tukipilarikirkko featured exposed wooden structural elements as built-in components of exterior walls. These elements were achieved by cross stacking timber logs with the traditional corner jointing technique into slender towers which supported the nave joists. With the primary tool available being the axe, the craft required careful knowledge of the properties of wood in order to achieve a weather tight joint. Block pillars facilitated the use of what we now commonly understand as the curtain wall; the exterior wooden curtains had no structural necessity so the dimensions of the length of the church were no longer dictated by the size of a tree. Thus, solving a problem that had not necessarily hampered the rapid construction of the single-family home, but presented difficulty in public building projects.



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Wood structure was the main construction tradition for multistory buildings in Finland well into the early part of the 20th century until the regional styles were influenced by Neoclassicism and Gothic Revival, both of which utilized masonry. It was also at this time that the balloon frame was being demonstrated in the United States, and eventually became widely practiced in Finland, making the timber block pillar a fleeting fixture in Finnish architecture. The introduction of iron during the Industrial Revolution closed another chapter of the wood tradition, and later in the 1900's steel became the globally-adopted primary structural material, and has been so for the last 200 years.

There is a similar relationship of building traditions between the U.S. and Nordic countries that is of value when making comparisons between the two within our current context. With the widespread abundancy of timber in both lands, it brings into question the discrepancy between its implementation in common architectural and building practices (Finland is renowned as the world leader in the timber construction industry, with log components and assemblies being the nation's largest export[5], meanwhile in the States, building codes and lack of suppliers have contributed to timber remaining a less popular option than concrete and steel). Additionally, the domestic emphasis on sustainability in recent years would seem to indicate that the U.S. is on a trajectory to transition

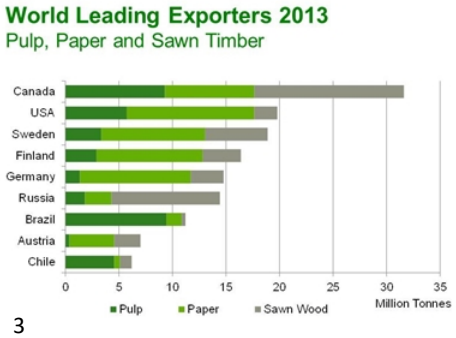

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Figure 2: Finnish Block Pillar Construction
Figure 3: World Timber Exporters 2013, *Swedish Forest Industries Federation*

back to the use of timber, as Finland has successfully demonstrated. My research intends to identify the characteristics embedded in traditional timber structural methods in order to make an argument for their implementation today.

THE CASE FOR CRAFT-BASED ARCHITECTURE

My interests in structural timber goes beyond the sustainability measures it can afford, however. During the 1600's neither block pillar technology nor the churches in which they were implemented were designed by architects or engineers, but by skilled craftsmen who worked with the material and understood it's limitations. These craftspeople possessed an indispensable wealth of tacit knowledge, allowing them to be the authoritative figure of design on new buildings. Through my past research I have found that the transition of authoritative power between the skilled craftsman and the eventual institutionalized architect played a significant role on the "commercial manipulation" that Pallasmaa speaks of (in life and in practice). I feel it is important to highlight this effect as it relates to craft's value in architecture in the pursuit of buildings that are designed for the inhabitation of human beings.

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HUMAN-CENTERED DESIGN

Livability of place, quality of dwelling, and the individual experiences each person has in a building encompass an area of design theory I am passionate about, and am blessed to currently work in an organization that stresses these principles. On the other hand, it has become increasingly apparent that such a premise is difficult in a consumptive and temporal context. The parametricized and computationally stylized architecture that has become popular with my generation has a tendency to stress *visual noise* rather than Michael Benedikt's "direct esthetic *experience* of the real[6]." I subscribe to the notion that the hand connects designs to our brain, and is still our most powerful design tool. A tool that can be enhanced by technology, but should not be relinquished to. It is what makes architecture *good* architecture because of its dialogue with natural things which promotes a human-mind-body-centric architecture. Therein lies the intrinsic value of wood, and why it in my opinion should be utilized more frequently in American commercial and public architecture, as the Scandinavians have been able to do.

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The main reason for this investigation into block timber is in response to these observations, and I believe that by learning the craft and inherent properties behind this traditional architectural element, it will bring valuable insight to my professional practice as I continue a negotiation between the design tools I use and the end product at the site.

ECONOMICS

Probably the largest factors involved with the current limitations in timber's American widespread use is economics and building code regulation. Expressing tectonics in architecture insinuates an exposed structural system, in plain view to the building occupants. For the sake of economy, most projects that leave a standard office shy away from exposing these elements, favoring a clean

Figure 4: Craftsman preparing a corner joint
Figure 5: Utajärvi Church interior, Oulu Finland

envelope that conceals an oftentimes messy network of welded beams, columns, joists, and bracing. Clients are just as apt to sidestep the costs associated with fireproofing exposed structure, or the more intensive detailing work it will take to achieve a more refined aesthetic. Often, we see craft fall victim to value engineering.

With the historical survey above as a framing mechanism, the question should be asked today if, given the technology at our disposal, economics is still a legitimate hinderance to the progression of exposed structural timber? This is what I will attempt to answer at the culmination of my travels as a means by which to instill relevancy into the investigation of a traditionally craft-based architecture. To do so will require investigating current and future practices.

CURRENT AND FUTURE PRACTICES

Does tucking a column away in a wall hinder the way we experience buildings, and does it limit our creativity as designers? Is this a necessity with the technology we have at our expenditure today? What is the cost of designing a beautifully exposed steel structure compared to a wood one? There are a number of relevant technological advancements going on today in Finland and other parts of the world that are beginning to start answering some of these questions.

Wood Program, *Aalto University: School of Arts, Design and Architecture, Espoo Finland*

The Wood Program is a research studio that explores a range of topics concerning contemporary and traditional wood structures in cooperation with Finland's Department of Forest Products Technology, and the Department of Civil and Environmental Engineering. They are on the leading edge of timber technology and have played an important role in reestablishing the craft. Wood Program students and faculty would be a valuable entity to consult during the fellowship.

Finscan Oy, *Espoo Finland*

Finscan Oy is a privately-owned Finnish technology company, which manufactures automated grading systems for the sawmill industry. Their products rely on 3d log scanning technology that can predetermine precise cutting patterns of individual logs, increasing efficiencies of lumber mills significantly. CT scanning technologies being developed by companies like Finscan and Microtec could be key to lowering the costs associated with exposed structural timber elements.

Finnish Forest Research Institute, *Helsinki Finland*

The Finnish Forest Research Institute (Metla) is the main innovation thinktank for Europe's most forested country. The organization is the leading source of new knowledge for a bioeconomic society that relies on natural resources to function sustainably. The Metla Building at University of Joensuu is a primary example of exposed structural timber

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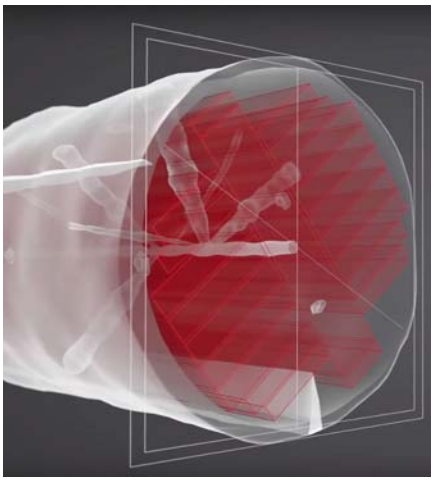
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Figure 6: WDC Pavilion, *Wood Program*
Figure 7: 360 degree scan of a log, *Microtec*
Figure 8: Metla Building timber columns, *Helsinki -SARC Architects*

and craft-based design. It will be essential to this research project not only to visit and document the relationships between the body and the structural members at this specific site, but to document successful relationships of a bioeconomic industry from knowledge gained through interviews with members of the Metla organization.

RESEARCH QUESTION

My research will revolve around two main questions:
1. What is the cultural value of exposed structural timber?
2. What is the economic value of exposed structural timber?

For the cultural value exploration, I would specifically be looking to answer the following questions:

- What are the principles embedded in traditional block timber construction that can be extracted for modern application?

- How does wood structure enhance craft's value in the architectural terms of improving living conditions for human beings?

Economically, my main question revolves around the relationship between our 200-year-old default to using steel as the primary structural element, and the costs associated with introducing a stronger timber culture and technology to the United States in the form of exposed tectonics.

- I would like to quantify our current economic gap between the two structural methods

- Is economy still a legitimate hinderance to the progression of exposed structural timber?

- For the scope of this project I will have to avoid looking into the building ordinances and governmental regulation differences between the U.S. and Finland, but that would certainly be an appropriate follow-up should I have the means to continue this research.

RESEARCH FORMAT AND METHOD

Pre-travel: I intend to lay the foundation for a thorough understanding of Finnish block timber through an historical literary search prior to my leaving for on-site analysis. This will give me a better idea of what I need to physically explore, and what information I cannot locate in periodicals that I need to see for myself.

The front portion of the research will deal with the cultural value, and will focus primarily on gathering precedent knowledge by visiting tukipilarikirkko parishes. I intend to document the process of block timber fabrication as well as the tectonic conditions of an assembled structure both in diagram form and in photographic/videographic evidence.

The remaining portion of inquiry encompasses the economic viability of implementing an exposed structural timber culture into the United States building industry. The framework can be organized around a case study comparison of four main typologies: the costs to design and build concealed steel frame, concealed timber frame, exposed steel, and the exposed timber building.

LOGISTICS

The itinerary of the trip overall may not necessarily reflect the chronological order in which the research format and method is laid out. This is intentional, both for cost-effectiveness and to have a positive alternation between the traditional investigation and the technological survey. The intent being to visit as many traditional wooden churches as I can, and along such route be able to interview key organizations and institutions that will help inform my inquiry about the economic trajectory of wood structural methodologies.

The scope of travel would begin primarily in Helsinki. From there I plan to travel west to meet with students and faculty at Aalto University in Espoo, and eventually venture north to Oulu with stops at two cities along the way in order to document the tectonic conditions of historical wooden churches. Finland has a robust public transit network which will be a vital resource for this exploration. Key sites are listed and mapped below:

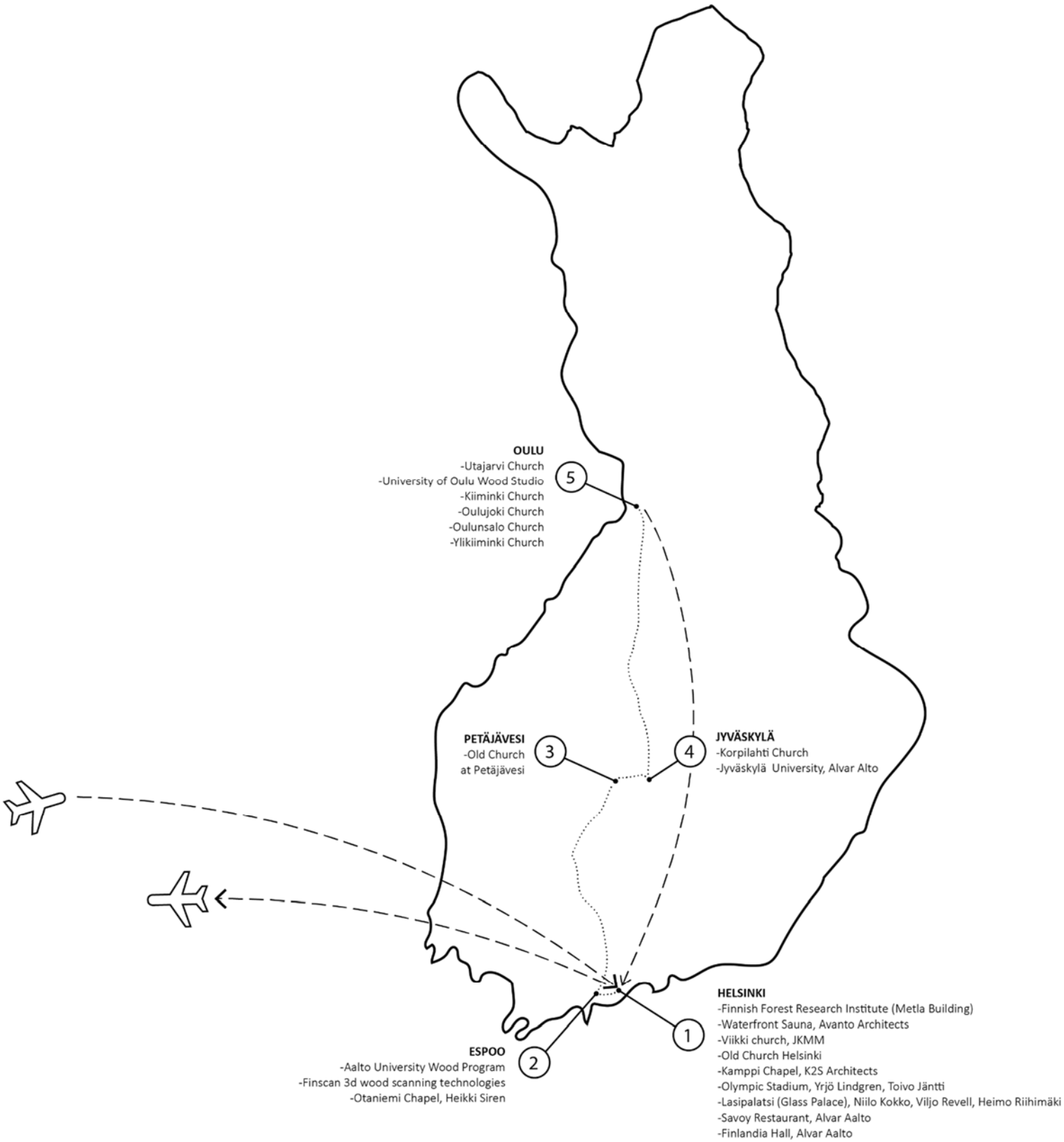
Helsinki [4 days]: Interviews at Finnish Forest Research Institute, Metla Building tour by SARC Architects. Site visit to Waterfront Sauna by Avanto Architects. Site visit to The Old Church Helsinki, site visit to Kamppi Chapel by K2S Architects.

Espoo [2 days]: Interviews and meetings at Aalto University Wood Program with Pekka Heikkinen (Professor in Wood Architecture), tour of Finscan facilities. Site visit to Otaniemi Chapel.

Petäjävesi [1 day]: Old Church at Petäjävesi site documentation.

Jyväskylä [1.5 days]: Korpilahti Church site documentation, Jyväskylä University Building visit by Alvar Aalto.

Oulu [5 days]: Utajarvi Church, University of Oulu Wood Studio, Kiiminki Church, Oulujoki Church, Oulunsalo Church, Ylikiiminki Church site visits.


OULU
-Utajarvi Church
-University of Oulu Wood Studio
-Kiiminki Church
-Oulujoki Church
-Oulunsalo Church
-Ylikiiminki Church
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PETÄJÄVESI
-Old Church
at Petäjävesi
3
4
JYVÄSKYLÄ
-Korpilahti Church
-Jyväskylä University, Alvar Alto
HELSINKI
-Finnish Forest Research Institute (Metla Building)
-Waterfront Sauna, Avanto Architects
-Viikki church, JKMM
-Old Church Helsinki
-Kamppi Chapel, K2S Architects
-Olympic Stadium, Yrjö Lindgren, Toivo Jäntti
-Lasipalatsi (Glass Palace), Niilo Kokko, Viljo Revell, Heimo Riihimäki
-Savoy Restaurant, Alvar Aalto
-Finlandia Hall, Alvar Aalto
1
ESPOO
-Aalto University Wood Program
-Finscan 3d wood scanning technologies
-Otaniemi Chapel, Heikki Siren
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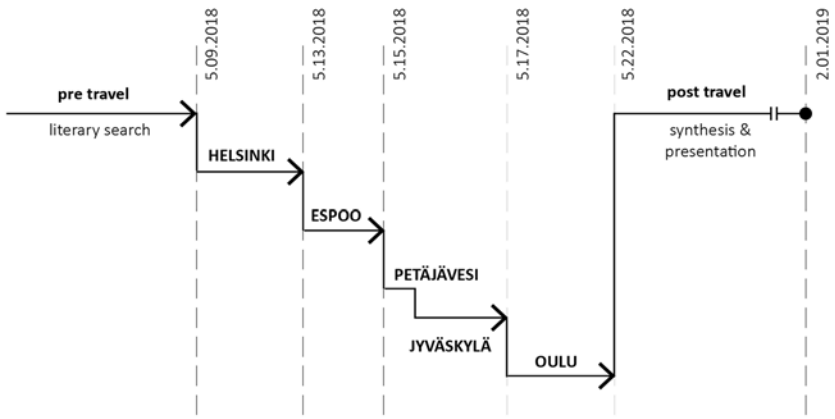
BUDGET

It is expected that the Fellowship stipend of $3,000 will be put towards travel fares and lodging costs, estimated below:

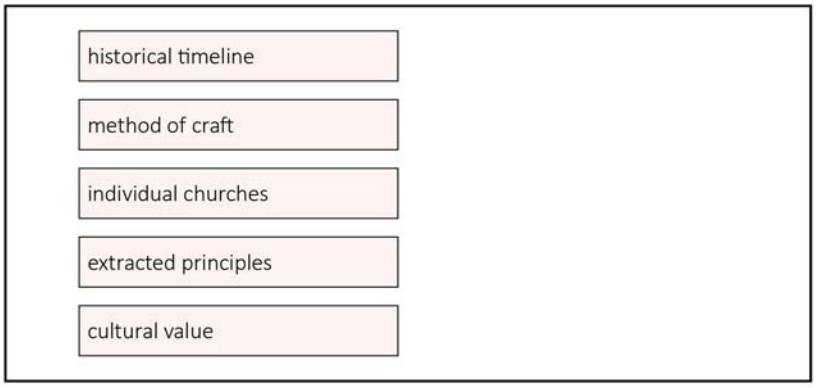
Activity	*Expense*	*date, 2018*
Rental Car from Detroit to Chicago	$115	9-May
Round trip airfare Chicago to Helsinki, Icelandair	$670	9-May
5 day regional transport ticket in Helsinki	$27	
Eurohostel Helsinki	52	9-May
Eurohostel Helsinki	52	10-May
Eurohostel Helsinki	52	11-May
Eurohostel Helsinki	52	12-May
bus ticket to Espoo	15	13-May
airbnb Espoo	31	13-May
airbnb Espoo	31	14-May
ticket to Petäjävesi	25	15-May
airbnb Petäjävesi	60	15-May
bus fare within Petäjävesi	10	15-May
bus ticket to Jyväskylä	5	16-May
airbnb Jyväskylä	50	16-May
ticket to Oulu	25	17-May
travels in Oulu	150	may 17-20
Radisson Blu Hotel, Oulu	119	17-May
Radisson Blu Hotel, Oulu	119	18-May
Radisson Blu Hotel, Oulu	119	19-May
Radisson Blu Hotel, Oulu	119	20-May
flight from Oulu to Helsinki	97	21-May
Eurohostel Helsinki	52	21-May
Rental Car from Chicago to Detroit	115	22-May
total travel and lodging expenses (estimated)	$2,162	
available for food	$838	
Pellerin Stipend Total	$3,000	
[contignency at own expense]		

TIMELINE

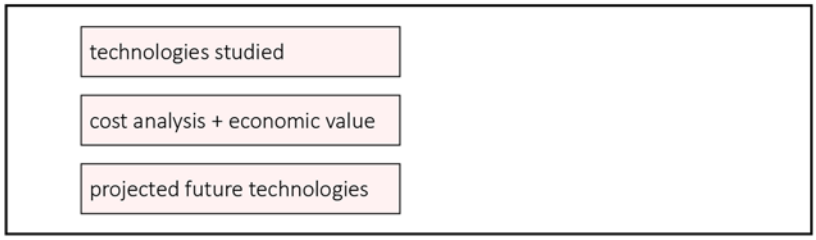


PRESENTATION DRAFT

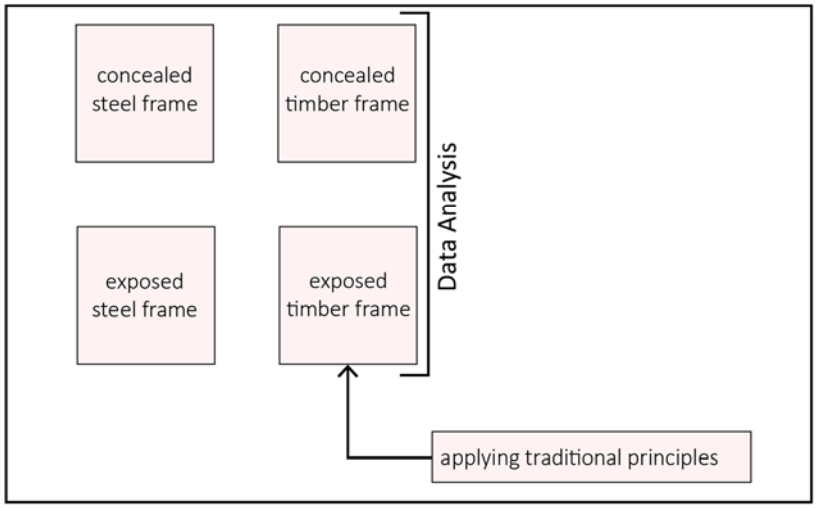
Historical Overview of Finnish Block Pillar Tradition



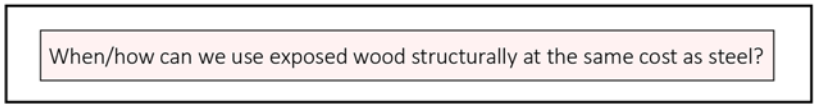
Technological Overview of Modern Structural Timber



Case Study Analysis



Conclusions



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Thank you for your consideration.